Bureau of Standards
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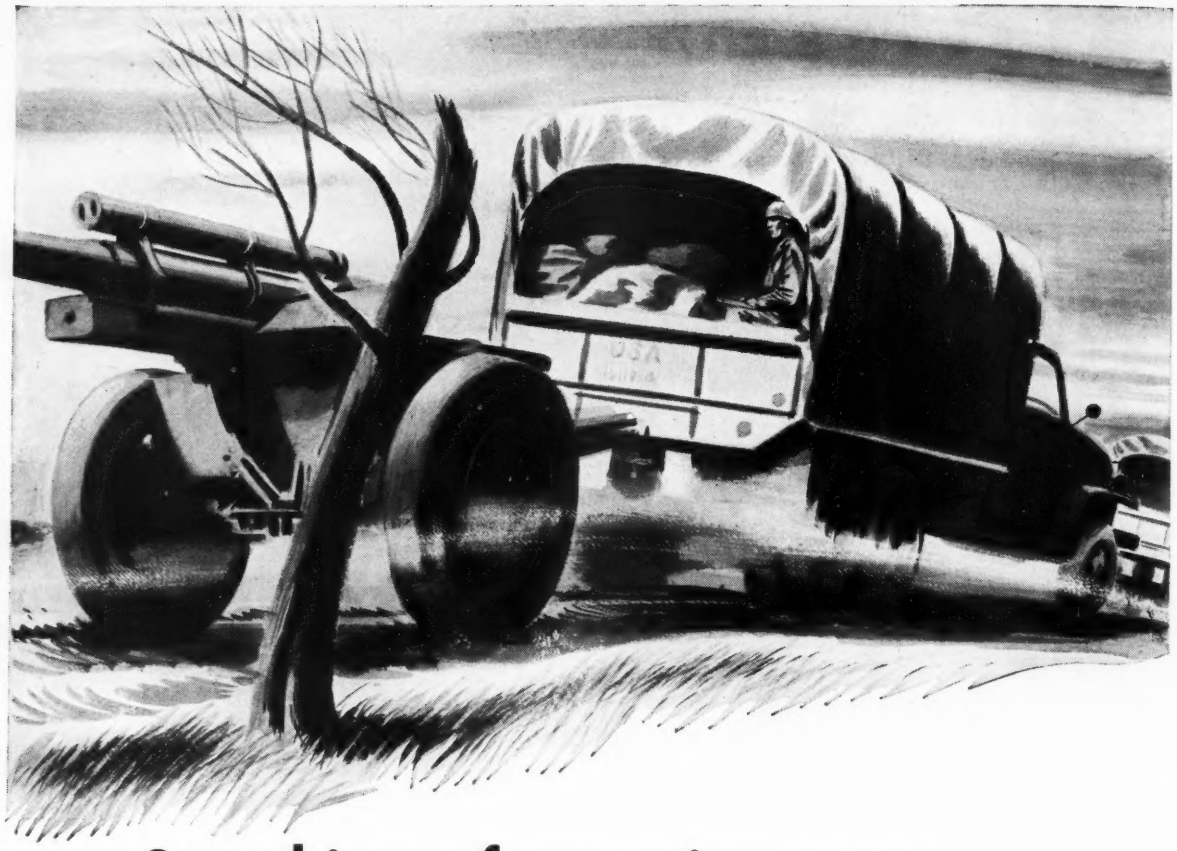
April, 1943

COLLEGE OF ENGINEERING · CORNELL UNIVERSITY



Speaking of superior races . . .

Every wheel that rolls on the battlefield turns in a polished bearing race, ruggedly built to take the terrific shock of combat service.

To withstand such punishment, bearing races must be hardened by heat-treatment. Hard and soft spots occasionally occur. Such races may fail—at times when failure means disaster.

Recognizing the vital need, Westinghouse Research Engineers P. H. Brace and C. S. Williams set to work to develop a quick, sure method of detecting these flaws.

Their ingenious electromagnetic flaw-detector is based upon the fundamental law that the *permeability* of a heat-treated steel part varies with the degree of hardness.

In actual practice, Brace and Williams first *completely* demagnetize the bearing race under test. Next it is rapidly rotated and strongly magnetized. While the race is still turning at high speed its magnetic field is explored with a specially designed electromagnetic "pick-up."

Variations in the magnetic field of the bearing race, due to hard or soft spots, induce feeble currents in the pick-up system. These currents are amplified and shown on a cathode-ray oscilloscope.

A uniformly heat-treated bearing race traces a *luminous straight line* on the oscilloscope screen. Faulty heat-treating shows up as a pattern of *hills and valleys.*

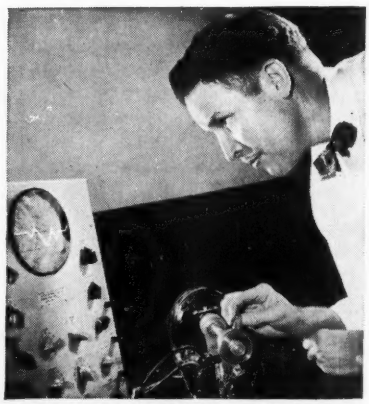
The Brace-Williams electromagnetic flaw-detector is now being used commercially—a typical example of Westinghouse *electronics at work.* It assures quality in millions of bearing races for our armed forces, *to keep 'em rolling on to victory!*

★ ★ ★

What Brace and Williams did—by employing Westinghouse "know how" to develop the magnetic flaw detector—many young Westinghouse scientists are now doing in other fields of fundamental research.

Today, they are helping to solve the technical problems of modern warfare. Tomorrow, they will tackle the job of building a better world for all of us.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pennsylvania.



ELECTRONIC FINGERPRINTS—Westinghouse Research Engineer C. S. Williams demonstrates the principle of the electromagnetic flaw-detector. Hard spots in the steel test piece show up as an irregular line on the oscilloscope screen. Williams joined Westinghouse after receiving his B. S. in Electrical Engineering at Northwestern University.

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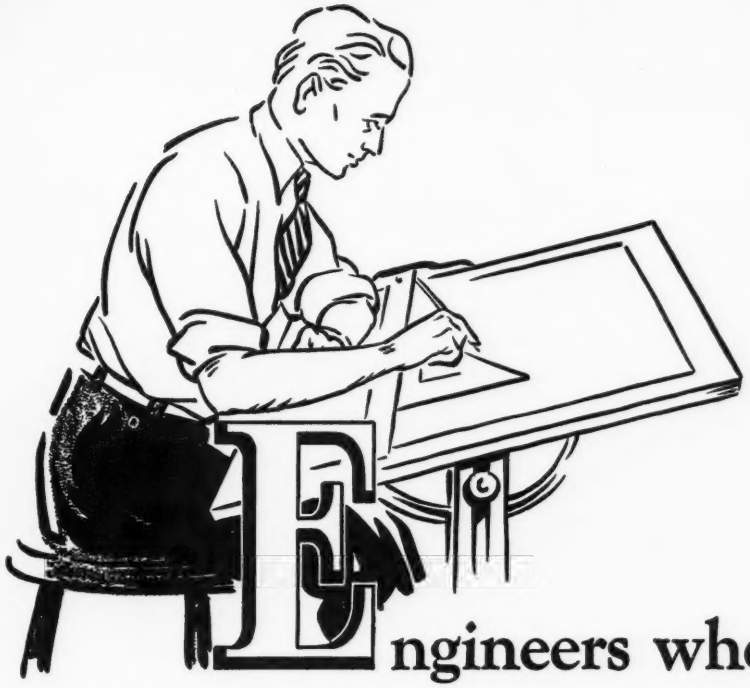
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at work



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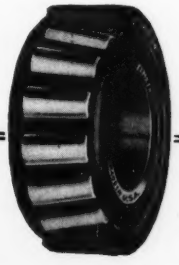

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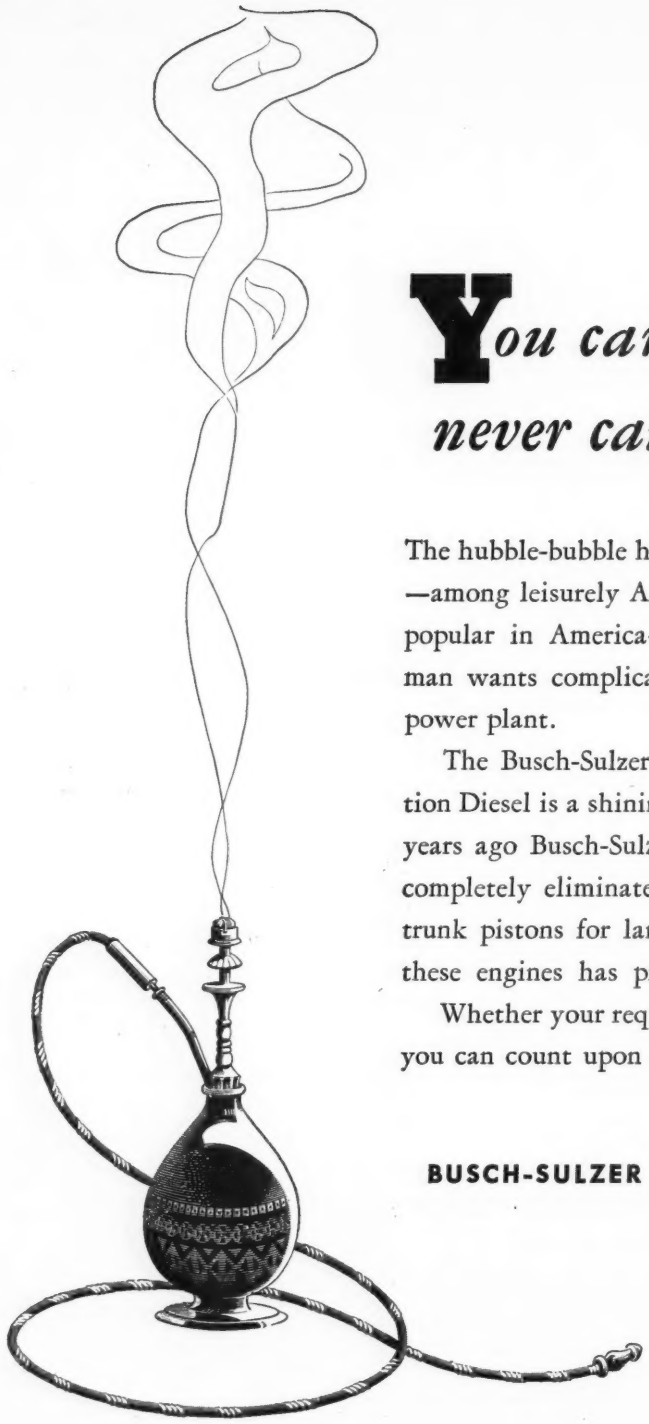

You can see why this pipe never caught on in the U. S.

The hubble-bubble has made many millions of contented smokers —among leisurely Asiatics. One word tells what it lacked to be popular in America—simplicity. In this fast-moving land, no man wants complications, either in his pipe, his plans or his power plant.

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Cover: Arthur J. Mack instructing Cadette Martha McMillan at one of the lathes in Rand Hall. See article on page 8.

—Photo by D. Robertson

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—*Courtesy Westinghouse*

One Type of Industrial Rotor Balancing Machine

Sensitivity of the Double Fulcrum Balancing Machine

By STANLEY SCHAUSS, E.E. '29

Instructor in Electrical Engineering

WHEN rotating machinery was first used, no great attention was given to the balancing of rotors before putting the machines in service, nor did it appear necessary to consider the effects of unbalance because of the comparatively small masses and low speeds then involved. The problem came into focus when studies of the failure of several large turbines revealed the existence of fatigue stresses associated with the vibration of the unbalanced rotors. Furthermore, the vibrations transmitted through buildings from small rotating machines such as motors and blowers proved objectionable and demanded remedy for the sake of comfort even when no element of safety or durability was involved. Although such vibrations can be reduced in amplitude by proper mounting of machinery and adjustment of speed, it is obvious that the real solution lies in proper balancing of rotors to remove most of the trouble at its source.

Within recent years many types of balancing machine have been devised. Some of these may be called automatic in the sense that they quickly indicate the mass needed for balance, and its proper location. Others are suitable for use with the heaviest turbine and generator rotors that have been built, and can detect an unbalance of one pound at a radius of 15 inches from the axis of a rotor weighing 120 tons, at a speed not above 300 rpm.

The purpose of this article is to state the problem of rotor balancing in simple mechanical terms, to describe some of the essential parts of the double fulcrum balancing machine, to obtain an expression for the sensitivity of the machine, and to discuss several factors affecting this sensitivity. Special attention will be given to the effect of frictional forces.

Statement of the Problem

Through the mass center of any rigid body there are three mutually perpendicular axes about which the body will spin in rotational equilibrium. These are known as the principal axes of inertia. If a body is set in rotation about some other axis, and then released of all constraints, its axis of rotation will shift and tend to come into coincidence with one of the principal axes. As a corollary, it may be said that an attempt to force a body to rotate about an axis which is not a principal axis will produce reactions in the bearings carrying the shaft on which the body is mounted. A rotor is balanced, therefore, when one of its principal axes of inertia coincides with the center of its shaft.

THE AUTHOR

AFTER receiving his B.E.E. degree from Cornell in 1929, Mr. Schauss spent several years with Westinghouse Electric and Manufacturing Co. In 1934 he started teaching courses in physics, electrical measurements and mechanics at Cooper Union. During this period, he received his Sc.M. degree from New York University. He is a member of Eta Kappa Nu and Phi Kappa Phi.

Last July Mr. Schauss joined the staff of the School of Electrical Engineering, and is instructing in the senior courses in Electrical Laboratory.

The accompanying article is based on the solution of a recent practical problem.

Stanley Schauss

It is quite possible that the mass center of a rotor lie in the center-line of the shaft without having a principal axis of inertia coincide with the center-line of the shaft. In fact, this is the distinction between static and dynamic balance.

The geometric axis of any solid of revolution is also a principal axis of inertia if density is uniform throughout the body or varies as a function of the radius. Therefore, the unbalance of the rotor of a turbine, generator, or motor results from the unavoidable imperfections of the manufacturing process. When a rotor reaches the balancing machine, it may be in neither static nor dynamic balance. It may be brought into balance, both static and dynamic, by the addition of a mass in each of two different planes to which the axis of rotation is perpendicular.

Elements of the Balancing Machine

The double fulcrum balancing machine consists of a frame supported by springs (four shown in the figure) whose required stiffness is dependent upon the mass of the rotor being balanced. The rotor is mounted as shown, and the frame is pivoted to vibrate about the fulcrum G. The rotor is driven above the speed at which the entire system would vibrate about the fulcrum G if it were pushed from its equilibrium position and released while the rotor were not turning. The rotor is then allowed to "coast," and the large amplitude of frame vibration as the rotor speed passes through this resonant value is read from the indicator V. When the proper mass is properly located on the right end of the rotor, the indicator V will show no vibration. Next, the fulcrum G is released, and H is used as the fulcrum. Another mass is added to the rotor in the plane that contains the fulcrum G and is perpendicular to the axis of the rotor. When a zero reading of the indicator U is obtained in the manner previously described, the rotor is in static and dynamic balance.

One should notice that the mass first added need not be in the plane of the fulcrum that is used last, but the mass last added must be in the plane of the fulcrum that is used first. This is true because the addition of the second mass in a plane other than that of the fulcrum G would disturb the balance previously obtained by the addition of the first mass at the right end of the rotor.

Analysis of the Motion

Analyses of the vibratory motions of the frame and rotor about the two fulcrums G and H will differ only in the numerical values of the quantities involved. Therefore, the motion about the fulcrum G will be described in terms of the following symbols:

K — the moment of inertia of the frame and the rotor about the fulcrum G.

mr — the unbalance of the right end of the rotor, which is to be remedied by adding a mass m at a distance r on the opposite side of the axis of rotation.

ω — the angular velocity of the rotor, expressed in radians per second, equal to $\frac{2\pi\ (\text{r.p.m.})}{60}$.

l — length of the rotor.

s — distance between springs.

c — the spring constant of the pair of springs beneath the fulcrum H. The corresponding constant in rotational units has the value cs^2.

Θ — displacement of the frame from its equilibrium position, expressed in radians.

A — amplitude of the angle Θ.

k — proportionality constant between frictional torque and angular velocity, such that torque is equal to $k\frac{d\Theta}{dt}$.

Units of the foot-pound-second system are used throughout.

An assumption that frictional torque is directly proportional to angular velocity may seem arbitrary, and really is. However, this is the only type of friction for which the resulting differential equation of motion can be solved without great mathematical difficulty. Fulcrum friction torque can be closely approximated by a component independent of angular velocity plus a component proportional to angular velocity, and air damping torque varies as the angular velocity raised to some power between 1 and 2. Therefore, after solving for the amplitude of motion with friction torque proportional to angular velocity, the effects of other types of friction will be considered.

The centrifugal force exerted on the frame and rotor by the unbalance mr is $mr\omega^2$, and the torque about the fulcrum G is $mrl\omega^2\cos\omega t$. The friction torque is $-k\frac{d\Theta}{dt}$ and the restoring torque of the springs is $-cs^2\Theta$. When the sum of these torques is equated to the rate of change of angular momentum, the resulting equation of motion is:

$$mrl\omega^2\cos\omega t - k\frac{d\Theta}{dt} - cs^2\Theta = K\frac{d^2\Theta}{dt^2}.$$

A solution of the form

$$\Theta = A\cos(\omega t + c)$$

is found to satisfy this equation with

$$A = \frac{mrl\omega}{\sqrt{k^2 + \left(K\omega - \frac{cs^2}{\omega}\right)^2}}$$

At the angular velocity of resonance, $\omega = s\sqrt{\frac{c}{K}}$, and the value of A becomes $\frac{mrl\omega}{k}$. The sensitivity of the machine, its ratio of response to cause, is seen to be A/mr, or $l\omega/k$. The sensitivity is improved by keeping friction torque as low as possible and by raising the angular velocity of resonance. The latter is accomplished by making the frame as light as is consistent with rigidity and by using stiff springs. Of course, the resonant speed should not be forced above the safe operating speed of the rotor.

The expression obtained for the amplitude A is analogous to that for charge Q in a series electrical circuit of resistance, inductance, and capacity. Velocity amplitude in the mechanical system is proportional to the product ωA, and current amplitude in the electrical circuit is proportional to the product ωQ. If both sides of the expression for A are multiplied by ω, the result is

$$\omega A = \frac{mrl\omega^2}{\sqrt{k^2 + \left(K\omega - \frac{cs^2}{\omega}\right)^2}}, \text{ which}$$

resembles the expression for current in the electric circuit

$$I = \frac{E}{\sqrt{R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2}}$$

Effect of Friction That is Not Proportional to Velocity

If the friction torque term in the equation of motion involves a power of angular velocity other than the first, the equation is difficult to solve. In fact, only a few special cases can

be handled by exact mathematical methods. An approximate method that gives useful results is to calculate the energy absorbed per cycle in overcoming the friction torques actually present, and then to use a value of k which gives the same energy absorption per cycle. The method is only approximate because k can not be calculated accurately without a full knowledge of the motion, nor can the motion be described without knowledge of k. However, the approximation is very good if the energy loss per cycle is small in comparison with the energy stored in the springs at their maximum displacement. This condition is reasonably well met at the large resonant amplitude of vibration.

Regardless of the nature of the friction torque, the energy absorbed per cycle can be found by evaluating $\int f d\Theta$ over a cycl ewhere f is the friction torque and $d\Theta$ the corresponding change in angular position. For a displacement of the form $\Theta = A \cos\omega t$ and a friction torque $f = k\frac{d\Theta}{dt}$,

Energy loss per cycle

$$= \int_0^{2\pi} k\omega A^2 \sin^2\omega t \, d(\omega t) = k\omega A^2 \pi.$$

Likewise for a frictional torque

$$f = a\left(\frac{d\Theta}{dt}\right)^2,$$

Energy loss per cycle

$$= 2\int_0^{\pi} a\omega^2 A^3 \sin^3\omega t \, d(\omega t)$$

$$= \frac{8}{3} a\omega^2 A^3.$$

Upon equating this to $k\omega A^2\pi$, the "equivalent" value of k is seen to be $\frac{8a\omega A}{3\pi}$. When this k is substituted in the amplitude expression, the result is that at resonance $A = \sqrt{\frac{3\pi}{8}\frac{mrl}{a}}$.

Here the amplitude of response is independent of the value of ω at resonance, and is proportional to the square root of the unbalance mr rather than the first power. The meaning is that, insofar as this type of friction is concerned, one can not improve the response of the balancing machine by raising the resonant speed.

In a similar manner, it can be shown that, for frictional torque proportional to the angular velocity raised to a power between zero and unity, the response is proportional to the resonant value of ω raised to a power greater than unity, and likewise increases more rapidly than the unbalance. As an extreme case, the theoretical treatment of a vibratory motion produced by a constant driving torque and opposed by a constant friction torque shows the possibility of an infinite amplitude of motion.

Summary

Because a rotor is considered to be balanced only when the indicators of the balancing machine read zero or less than some quantity specified as a tolerance, it is not important that there should be a linear, or even a known, relationship between response and unbalance. It is important, however, that a very small unbalance should produce an easily observable response. It has been shown that response varies as a power of resonant speed which is

(a) greater than unity if friction torque is proportional to a power of angular velocity of the frame less than unity,

(b) unity if friction torque is proportional to angular velocity,

(c) less than unity if friction torque is proportional to a power of angular velocity greater than unity, reaching independence of resonant speed when friction torque is proportional to the square of the angular velocity of the frame.

By use of the expressions

$$f \propto \left(\frac{d\Theta}{dt}\right)^n$$

$$A \propto (mr)^p$$

$$A \propto \omega^q$$

the results just stated may be arranged in the following table:

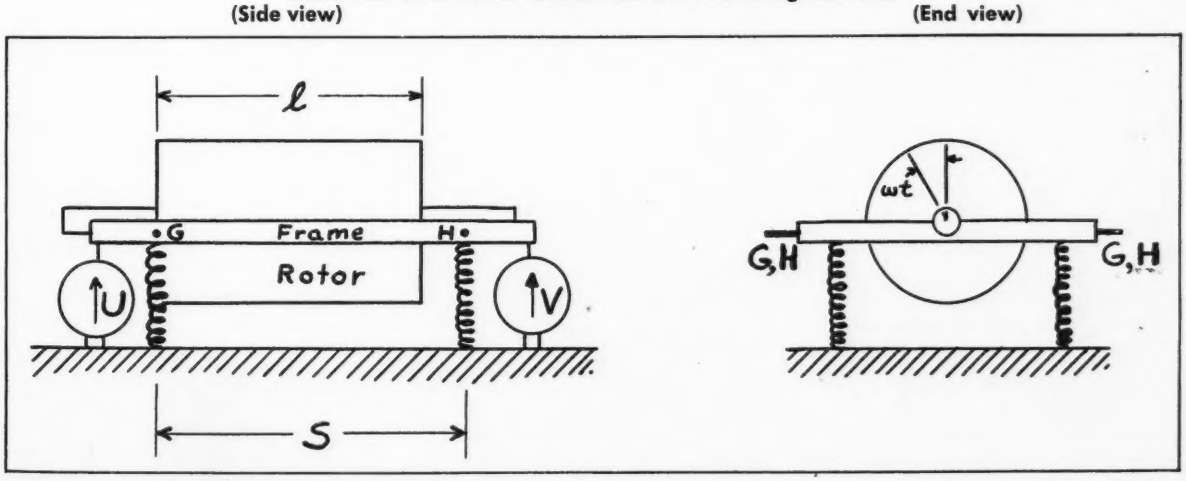
If $0 < n < 1$, then $p > 1$, and $2 > q > 1$

If $n = 1$, then $p = 1$, and $q = 1$

If $1 < n < 2$, then $1 > p > \frac{1}{2}$, and $1 > q > 0$

When air resistance, bearing friction, and energy losses in the supporting springs are combined as a single friction torque, the dependence of this friction torque upon angular velocity will surely lie within the limits discussed. Therefore, the sensitivity of the balancing machine can be improved by making the resonant speed as high as possible, but the response can not be taken as a direct measure of the unbalance of the rotor.

Schematic view of the double fulcrum balancing machine



Cadettes at Cornell

By FRED W. OCVIRK

Instructor in Aeronautical Engineering

A NEW kind of engineering student has come to the Cornell campus. This student is the Curtiss-Wright Engineering Cadette, a young woman, one of a hundred and fifteen now at Cornell. She represents something different because she is a part of an engineering training program especially created for young women. She is the substance of an educational experiment aimed at solving an important manpower problem.

The Curtiss-Wright Engineering Cadettes represent future womanpower. They are being trained because of the foresight this industry has had in looking into the personnel problems that are most certainly coming. The problems will involve both the demand for increased airplane production and the shortage of manpower. Engineering personnel must increase with expansion, but because manpower is being diverted into the armed forces, auxiliary womanpower in engineering must be developed. Both Curtiss-Wright and the University are pinning their faiths on the Cadettes as an answer to one of industry's personnel problems.

The Cadettes carry a big assignment. Like seven hundred other Cadettes who are being trained at six other universities, they bear the responsibility of preparing their minds and their skills to be of service to the aircraft industry and to their country. They are handicapped to the extent that by tradition their experiences have been womanly, and little, if at all, technical. They have not had the advantage of playing with Erector Sets and tinkering with Model T's. They have the rather tough job of catching up on things mechanical, and this in a relatively brief space of time.

The Cadette's assignment might seem to be a tough one, but it is somewhat softened because of the Cadette herself—because of her character and her capabilities as a student. Curtiss-Wright has selected her carefully for the work she is to do, and it may be said that the Cadette is the pick of the country's college women. The Cadette is twenty years of age on the average, of good appearance, possessing good scholarship, and was of sophomore standing or better before coming to Cornell. It is interesting to note in most cases she is a person who has participated in more than one sport or extracurricular activity. She is prepared to be a Cadette because she knows what it is to go to college and she knows how to study.

MR. Ocvirk is a pretty busy man these days. In addition to holding down the job of Coordinator between the Curtiss-Wright Company and Cornell University, both for the Engineering Cadette program on the campus and for the Curtiss-Wright Engineering and Management Institute in Buffalo, he is teaching an ESMWT course at Buffalo in aircraft structure.

After receiving his B.S. in C.E. degree in 1938 from Wayne University, Mr. Ocvirk worked as detail draftsman for the International Conveyor and Washer Corporation. Following that he was employed by Albert Kahn, Inc., industrial architects. He received his M.S. in C.E. degree in 1940 from the University of Illinois. He joined the Cornell ESMWT staff in December, 1940.

Mr. Ocvirk is a member of Sigma Xi, the ASCE, the Institute of Aeronautical Sciences, and the Society for the Promotion of Engineering Education.

Although each Cadette is a Curtis-Wright employee, complete with a clock number and a weekly salary check of ten dollars, she is also a Cornell student with all of the services and privileges accorded a regularly enrolled student. Curtiss-Wright also provides for her tuition, room and board, and traveling expenses to Cornell.

The Cadettes live in the Anna Comstock House on Thurston Avenue, lately vacated by women students, and which previous to that consisted of faculty apartments. Double-decker beds have been installed. The girls eat in Risley Hall, and hold classes in White, Franklin, East and West Sibley, Lincoln, and Rand Halls. Twenty-one Cornell staff members are involved in teaching them.

Curtiss-Wright has provided a counselor, known as the Curtiss-Wright Supervisor, to whom the Cadettes may turn for guidance and to whom they can air their enthusiasms and grievances. The Cadettes are responsible to the Supervisor as an employee of Curtiss-Wright. An account of each Cadette's scholarship, absences, behavior, and welfare is kept by the Supervisor in the interest of assisting her through the training and of best placing her when she reports for work at a Curtiss-Wright plant after training has been completed. The Supervisor at Cornell is Miss Isabel Lion, whose office is in Room 101 East Sibley.

The Cornell Cadettes are to be on the campus for forty-four weeks or approximately ten months. They began their formal class work on February 15th and will remain at Cornell until approximately December 15th. They carry forty hours of study per week in mathematics, mechanics, aircraft drafting, airplane terminology, aircraft materials and processes, shop practice, and physical education. Eight hours of supervised study in mathematics and mechanics are included in this forty hours. Although it may seem that this time is short for the Cadette to absorb the equivalent of the first two years of collegiate engineering training, it is far more than is usually allotted for war time accelerated programs for women.

The Curriculum

The curriculum the Cadettes are now following during their stay at Cornell was drawn up jointly by

Ellen Sauer receives welding instructions

representatives of the various Curtiss-Wright plants and the representatives of seven universities: Pennsylvania State College, University of Minnesota, Purdue University, Iowa State College, University of Texas, Rensselaer Polytechnic Institute and Cornell University.

The curriculum was drawn up with two purposes in mind. First, the Cadettes were to be given as good a basic engineering background as ten months would allow, and second, as much specific airplane engineering practice as possible was to be incorporated into this background. The first of these purposes was assured by the fact that the Cadettes were to attend a qualified engineering college for a period long enough to permit them to take the usual fundamental courses. The second purpose was to be effected by Curtiss-Wright providing the University with materials and equipment taken directly from its plant.

Perhaps the most important of the courses are the aircraft drafting courses. These will lack aircraft application until the techniques of orthographic projection and descriptive geometry have been mastered. Once these techniques are acquired the Cadettes will learn to duplicate Curtiss-Wright practice through the use of the company's engineering manuals, standard books and standard titled drawing paper.

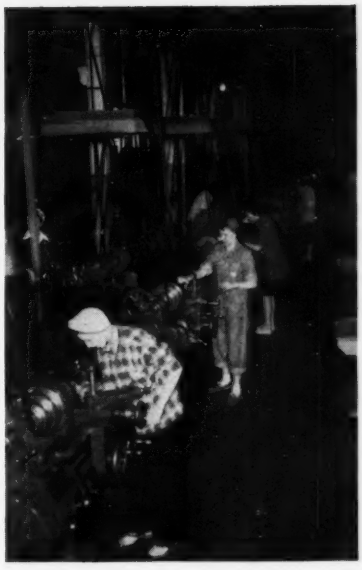
In mechanics and mathematics their courses will be fundamentally basic in character in the beginning until they have been well drilled in principles. In later stages specific aricraft problems will fall into these courses by degrees so that the Cadettes may undertake such courses as aerodynamics and aircraft structural analysis.

The first aircraft course is entitled "The Airplane." This is an elementary study which includes history of aircraft, types of aircraft, functions of the parts of an airplane, the simple forces of an airplane, airplane instruments, navigation and meteorology.

Other beginning courses which contain some aircraft applications, are the shop lecture course and the sheet metal shop course. The shop lecture course includes the study of materials and the processing of materials in which emphasis is placed upon the use of aluminum alloys and the special methods employed by the aircraft industry in the forming, casting, and machining of such alloys. The sheet metal shop course provides experience in shaping aluminum alloy sheet metal, filing it, welding it, heat treating it, and riveting it.

A special course in Curtiss-Wright engineering practices has been provided for the Cadettes in which they will receive intensive drilling on the use of the Curtiss-Wright engineering manual and the

Roddy Snider working at nibbling machine



Cadettes hard at work on lathes

Army - Navy - Curtiss standards books. Here they will also become acquainted with the functions of the various groups in the company's engineering department — such groups as the aerodynamics group, structural, weights, equipment, power plant, research, experimental, flight test, drafting and liaison groups.

Curtiss-Wright has done much to acquaint the Cadette with company practices by supplying materials and equipment directly from the Buffalo plant. Engineering manuals, materials testing manuals, and uals, materials testing manuals and standards books have been made available to both the Cadette and the University. One hundred and sixty prints of the Hawk-75 including major and minor assemblies and details have been supplied for reference and illustration as have diagrams, pictures, motion pictures, and charts. Reports from the structures group, aerodynamics group, and weights group have been placed in the hands of the Cadettes' instructors. The shop has received cutting, shaping, drilling, and riveting tools as well as aluminum alloy sheets, aluminum welding wire, aluminum alloy structural shapes and rivets.

The Cadettes studying at Cornell as well as at Pennsylvania State College are to be placed in the engineering department at the Buffalo plants of the Curtiss-Wright

(Continued on page 24)

City Planning

By BEN ROCKOWITZ, ME '45

WHEN we look down upon New York City from the top of one of its tall skyscrapers we are overwhelmed by the intricate pattern which lies before us. Below us are stretched out busy streets with their steady streams of traffic, the dark dwellings of slum areas, and industrial plants overladen with smoky mist.

As we gaze upon this panorama, it is difficult to realize that this huge metropolis originated from a small community. It is almost inconceivable that a hundred years ago there were no cities in the United States with a population of more than one hundred thousand people, the present population of Utica, New York.

Let us investigate the problems confronting such a community as it grows. To faciliate free and rapid transit from one locality to another, an adequate street system must be provided. With the addition of such a system, however, new problems arise. Storm sewers must be installed to provide drainage from the streets. When a community is small it can depend upon individual water sources, such as artesian wells, springs, etc. Similarly, individual sewage disposal facilities such as septic tanks are sufficient. An increase in population soon necessitates a change. A public water supply system must be established to handle the growing demand. Both domestic and industrial water consumption, as well as the high pressure requirements of fire-fighting, increase rapidly with the community.

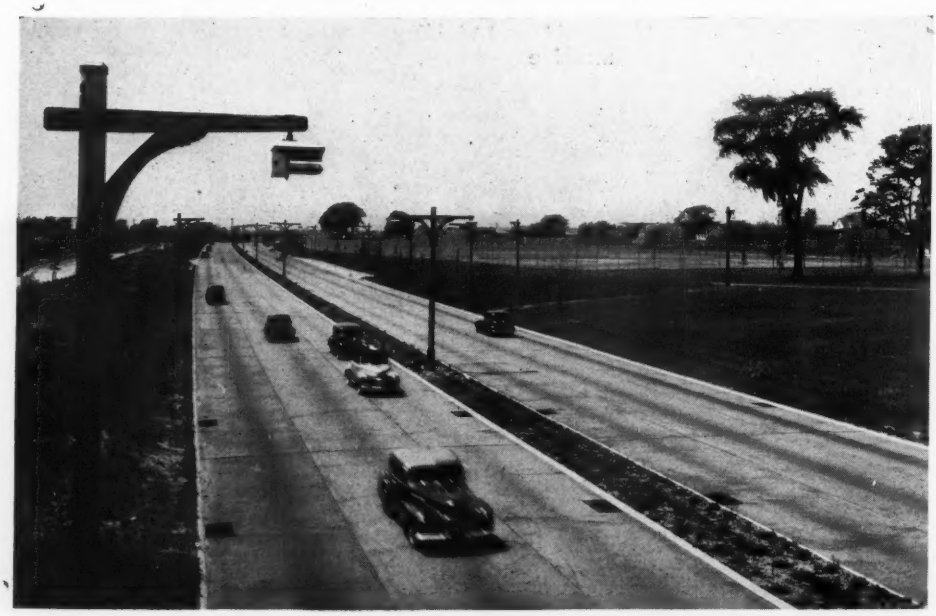
Parks must be provided. As the municipality develops, unfavorable social and economic conditions cause blighted areas. Zoning legislation must be enacted to protect existing property and control future use of land.

In brief, the engineering and allied engineering functions of public works and utilities, transportation, recreation, housing, and zoning are called upon repeatedly in the growing process to see that fundamentals are properly introduced into the community. These are some of the functions with which City Planning is concerned.

Before considering a detailed treatment of planning as it is today, it would be well to get a picture of it as it existed in the past and to trace its evolution to the modern broader concept.

Development of Planning

Prior to 1900, planning in this country was spasmodic and uncoordinated. The expansion to the West and the development of manufacturing, about 1840, brought about a mushroom growth of cities. Cities were laid out on the same general principle of rectangular blocks and streets, that was used by William Penn in laying out Philadelphia, and was later adopted by New York City. Little care was taken to adapt the street layout to the natural topographical advantages of the surrounding coun-



Section of Belt Parkway System in Queens, N. Y.

—Courtesy Dept. Parks, City of New York

try. Planning, at that time, concerned itself solely with the street layout. In many cases these "rectangular grid" systems were quite undesirable in spite of the "planning," such as in Wall Street, where the building height is too great for the street width.

Soon, however, certain individuals rebelled against the way towns were developing. William Cullen Bryant, in 1844, started the movement for more park areas in the City of New York. Robert Fleming Gourlay, a Scotsman, proposed plans for the improvement both of Manhattan Island and of the City of Boston. New York City, about this time improved its water supply by going to the Croton watershed. Parkway development was started in Westchester County in an attempt to protect this watershed by preventing adjacent areas from being built up.

The work of these pioneers was not in vain. In the latter part of the nineteenth century, City Planning dealt with more phases than it had previously included, and now embraced such considerations as sanitation, housing, park systems, transportation, and civic beauty.

Coordination

There is an important fact that must be considered here with reference to this planning. All these phases were carried out independently of each other. An engineer would be called in to design and install a water supply system, and by his own methods would determine the future needs of the community and the location and size of the system. Another expert, in developing a different phase, such as recreation, might anticipate the future needs of the community on an altogether different basis. This might cause serious confusion, for the concept that community projects should be accomplished in the proper relationship to each other and to the city as a whole did not then exist.

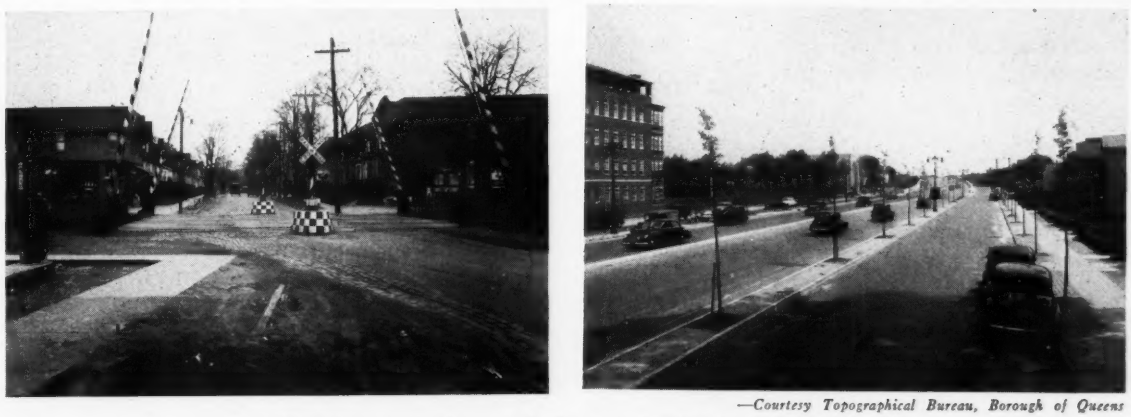
It was not until the twentieth century that City Planning became a coordination of the above factors. Any contemplated improvement must first be studied with a view to existing conditions and must fit, before acceptance, into a preconceived broad plan, called the Master Plan.

Thus, men from diverse professional groups can stand side by side and can look upon a complete interlocking system. They can locate the areas requiring immediate attention, and with complete knowledge of all of the existing conditions can make the best suggestions for the future. The maximum social welfare may be achieved by the fulfillment of the Master Plan according to the most applicable scientific approach.

With the development of this broader concept, how has this coordinated plan been put to work? City Planning Commissions have been set up. Such a group holds in its possession the Master Plan and has at its disposal a staff of trained experts to gather and coordinate data to be used in connection with it.

In order to carry out the actual work of city planning it is necessary to conduct a large number of preliminary studies which may be used in any of the various phases. Among the more important investigations are: economic—such as rents and land use; physical—such as the topography and location of utilities; and social—such as recreational facilities and population studies.

The available data is best used when presented in forms which make coordination possible. The facts to be emphasized are often more clearly shown and more easily related by the use of maps, diagrams, and models. Density of population, health conditions, land use, and other characteristics of the localities can be compared by different tones and colors on maps. Much of this work can be presented on charts, curves, bar graphs, tables of statistics, or by area diagrams of one sort or another. Some material, however, does not readily lend itself to representation in these ways. In such instances more detailed reports of preliminary work must be compiled.



—Courtesy Topographical Bureau, Borough of Queens

Woodhaven Boulevard, before and after improvement

Methods

There are various methods of gathering material for the compilation of these reports and maps. Because of budget limitations on most city planning offices, outside public and private sources must be tapped. These sources are quite varied and cover many fields, such as appraisal and rental maps, as drawn up by banks and real estate firms; government census reports; and reports of other governmental departments. Some of these sources are very good, but most have their limitations. However, the coordinator may base his plans on such data if

(*Continued on page 22*)

PROMINENT

Prof. Gifft

Prof. Howard M. Gifft, C.E.

Civil Engineers are now quite familiar with the face of Assistant Professor Howard Merrill Gifft. Though coming here only two years ago, he has made a place for himself and is now conducting courses in Structures and Sanitary Engineering.

Professor Gifft, hailing from Boone, Iowa, went to Iowa State's School of Architecture after leaving high school in his home town. That he really got around in college is seen in the fact that he was President of his class in his Sophomore year, and also a member of the Student Council. He joined the Kappa Sigma fraternity at this time also. At the end of his Sophomore year he left school for five year's work with the Iowa State Highway Commission. On this he was a Survey Party Chief for two years, and in Road and Bridge Design for three.

When he returned to college, he entered the School of Civil Engineering. However he still enjoyed art work very much, and became Art Editor of his campus humor magazine, and, as a sideline, head cheerleader for Iowa State. During this time he married an Iowa State coed. He received his B.S. in C.E. there in 1932.

Between 1932 and 1939 Professor Gifft worked for the State Conservation Commission in Iowa. This being similar to a State Park Commission, he was at the head of the organization which built 16 dams for the creation of artificial lakes and many other buildings related to the erection of new park facilities during the time he was an Engineer with them. In this work he received much valuable experience and thus is well qualified for his work at Cornell.

After he finished work with the Conservation Commission he went back to Iowa State as an Instructor in Civil Engineering until 1941 when he received his M.S. in C.E. and his degree of Civil Engineer there. Then he came to Cornell, where he was appointed Assistant Professor in Civil Engineering, the position which he holds now. He is a member of the A.S.C.E. and the S.P.E.E.

Professor Gifft, though a Westerner by nature, enjoys his work here at Cornell and has become a good friend to all C.E.'s with whom he has come in contact. Apparently he is one of the few and far between who really enjoy Ithaca weather, for he says that compared to the heat in the summertime and the cold in the wintertime in Iowa, Ithaca's climate is wonderful.

David J. Coons, AE

The story of David Joseph Coons, editor of the '43 Cornellian and highest-ranking AE senior, is a tale of persistency coupled with a few helpful boosts by Lady Luck.

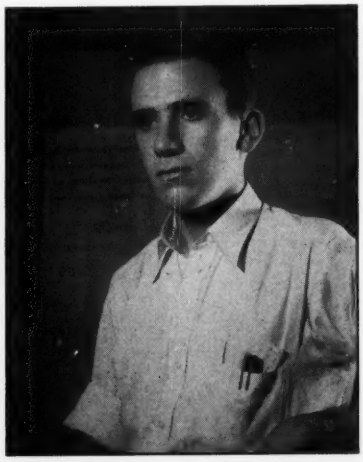
He was attracted to Cornell by the fame and reputation of the Administrative Engineering course, and in his freshman year he went out for the 150 pound crew. In that year, as in all succeeding years, he made the Dean's List. When he had enough time he hobbied with photography and bird study, occasionally rising at the hour when Chem. E.'s claim they go to bed and hiking extensively with intentions of spotting a few birds but being spotted instead by mosquitoes and other equally obnoxious insects. Most of the following summer was spent in an office, but Dave took a couple of weeks vacation at its end to indulge in his favorite recreation—camping. Along with another companion he made an extended canoe trip through the Adirondacks.

Dave was editor of his high school's year-book, and thus he came to devote most of his sophomore year to the Cornellian competion, which, incidentally, he didn't make. He was also a member of the Freshman Discipline Committee, but how much time was spent and how effective were the attempts to maintain order in '44's ranks is unknown. That summer he worked in a Hoboken shipyard as an ironworker's helper, assisting welders, riggers, structural steel workers and occasionally tossing around a white-hot rivet or two. It was during this summer that Lady Luck first stuck her finger into the Cornellian pie for David; for his successful Cornellian competitor resigned and Dave became sports editor for his junior year.

Dave was a member of Round Table for two years and was secretary of that discussion group during his junior year. In the spring of '42 Dave, Mike Sfat (former editor of the CORNELL ENGINEER), and two others represented Cornell at a conference held at Dartmouth attended by representatives from Cornell, Pennsylvania, and Dartmouth. The same semester he was elected to Tau Beta Pi, of

(*Continued on page* 28)

"Dave"



ENGINEERS

George McLaughlin, ME

IT MIGHT be said that a song brought George McGlaughlin to Cornell. He had been looking over the various colleges when his Dad chanced to hear the "Alma Mater" of Cornell. He liked it so much that the two investigated further. "Bud" and some pals visited here on Cornell Day and had such a wonderful time that both Bud and Jack Rice, his present roommate, chose Cornell. In spite of his subsequent discovery that all is not play, Bud has never doubted the wisdom of his choice.

Back in high school in Pittsburgh he had his own 12-piece band. With Bud directing and playing the guitar, the band played for several busy summers and during the school term often played at high school dances and local social affairs. Arriving here, Bud drifted in for a while with Scottie Brown's band, which eventually provided music for the Freshman Banquet.

He tried out for the pistol team and entered several competitions; of these, he liked the football competition best. The fact that he won remains to him a big surprise. Serving as assistant manager in his Junior year, this fall he became varsity football manager for the 1942 season.

As a Freshman, Bud pledged and joined the S. A. E. fraternity. In his Junior year he was elected to Atmos and Aleph Semach. As a Senior he was elected to Sphinx Head and served on the "Major C" Banquet Committee.

"Bud"

In the summer of 1941 he worked in the hot strip finish department of the Erwin Works of the Carnegie-Illinois Steel Co. The work was common labor, but the experience was worth it—in spite of an occasional "graveyard shift" or "swing shift."

Last summer Bud came up to school to get a head start on his studies. Football trips have the habit of clashing with assignments. In this regard, his summer-school work was a big help.

He also enjoyed three weeks up at his Dad's lodge in Canada. The place is located about three hundred miles north of Toronto. Roads lead to within 50 miles of the lodge, but from there transportation is by Indian-manned boats. A little steamboat passes daily, bringing

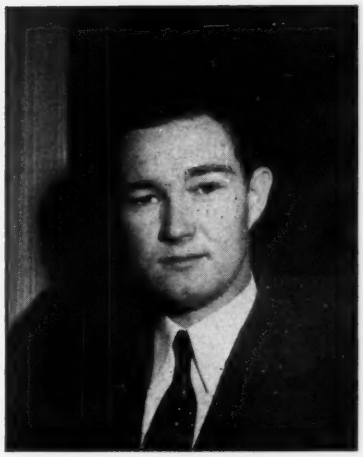
(*Continued on page* 28)

William Cornell, CE

IN THE fall of 1941, Cornell welcomed a sandy haired Virginian with a warm, generous smile. Since then Bill Correll has made a record and gathered a circle of friends that few can match even in four years.

Bill has wanted to become a civil engineer as long as he can remember. When he graduated from high school, circumstances prevented his going away to an engineering school, so he entered the University of Richmond. To judge from his record there, Bill must have had a busy four years. He majored in physics and had better than a B average. He was manager of the Track team in his senior year and was a member of the Varsity Club. He was on the student weekly for four years and became its advertising manager. Bill played a trumpet in the band for two years and sang in the glee club in his last two years. At Richmond, he joined the Kappa Alpha Order, a high ranking fraternity in the South.

For three years after graduating from Richmond, Bill worked for the



"Bill"

department of Public Works of the city of Richmond. Here he found that to get ahead in the field of engineering he would need more training. After talking to several engineers with whom he worked, Bill decided that his needs would best be served by coming to Cornell.

Bill came here with the idea of finishing the course offered as quickly as possible and learning as much as he could while he was here. In accomplishing the former, he is finishing the four year course in two years. Despite the fact that he has carried twenty-two or more hours each term, he has an average of better than 90%. Because of this record, he was given an Otto Eidlitz Scholarship this year. He has also been elected to Rod and Bob, Chi Epsilon, Phi Kappa Phi and Tau Beta Pi on the basis of this record. This winter, he was elected president of the A.S.C.E. student chapter.

A party loving boy like Bill could not spend two years here just grinding away on his studies so Saturday night usually finds him far from his books. Bill also plays enough golf to stay on swearing terms with a golf ball. When he's "down home" you will always find him at the Saturday night dance at the country club and playing golf at the club on Sunday afternoon.

After graduation in May, Bill will go on active duty as an Ensign in the Navy. After the war he would like to work for a company of engineers and contractors that does all types of construction work.

NEWS OF THE COLLEGE

Diesel Lab

ANNOUNCED recently by President Day was the completion of a new thirty thousand dollar Diesel Engine Laboratory. It is being used daily for the instruction of student officers in the Naval Training School.

The construction of the laboratory required the solving of several engineering problems. To cool the six engines, for instance, a large quantity of cold water was needed. Accordingly, a thirty thousand gallon cistern was dug beneath the structure to provide the necessary one thousand gallons per minute. The water is saved, recirculated through a spray system which cools it, and then goes back to the cistern for use again. It was also necessary to provide air compressors and tanks to furnish the compressed air for starting the large engines. The problem of noise reaching the other buildings was solved by installing mufflers as part of the exhaust system.

The Cornell diesel school for training student officers has been functioning since March thirty-first, nineteen forty one. This year, the quota has been increased to nine hundred officers per year.

Tau Beta Elects

The following men were elected to Tau Beta Pi, honorary engineering society.

H. Craig Allen, AE '43
Albert Beehler, Jr., ME '44
R. Thomas Cochran, II, CE '44
Gaston R. Desnoyers, ME '44
Perry T. Egbert, Jr., ME '43
David H. Esperson, ME '44
Robert H. Garmezy, EE '43
Jack H. McMinn, CE '44
Walter P. McQuade, Jr., Arch. '45
Edwin J. Mullens, III, Arch. '45
John C. Palms, CE '43
John T. Parrett, ME '44
Robert S. Rochlin, EE '44
Milton Stolaroff, EE '44
John E. Westberg, Chem E. '44

A class in military map-making at Cornell University has an enrollment of 24 women students who are preparing for employment with the Army Map Service. The course was inaugurated for the first time at Cornell this term, and students are required to put in a total of 60 hours over a 15-week period. All are seniors or graduate students.

At the first bench in foreground, left to right, are: Caroline Norfleet of Bethesda, Md., and Margaret Hall of Winchester, Mass. In the second row are Mrs. Lois Fogelsanger of Ithaca, Virginia Witmer of Port Washington, Mrs. Louise Johnson and Violet Dvorak, both of Ithaca.

At left center is Prof. P. H. Underwood of the School of Civil Engineering, in charge of map-making instruction.

Eta Kappa Nu

On Friday, March 19, Eta Kappa Nu sponsored the first social gathering held by the EE's in some time. Fred Arbuckle and Milt Stolaroff planned a very satisfactory evening's entertainment at the Phi Delta Theta house.

The strictly stag affair started off with a varied program of entertainment, including an interesting motion picture that was well received by all present. Following this an enthusiastic reception was given to a short demonstration of magic. In the meantime, beer, and soft drinks for those with Saturday classes, flowed freely. This led to an enjoyable session of singing and joke telling after the formal part of the program was concluded.

EE Text

A NEW book entitled *Electrical Engineering—Basic Analysis* by Associate Professor Everett M. Strong will be published next month. The book will be used as a text for Course 410, taken by sophomores in Electrical Engineering. For several years the volume has been used in mimeographed form. Revisions have been made each year, many at the suggestion of students taking the course

Starting with a general discussion of electrical knowledge, analogies, memorizing, etc., the text soon gets down to the task of clearly explaining each phase of the fundamentals of electrical knowledge.

Here and there bits of Professor Strong's inimitable humor emerge. The capacitor is described in terms of a ham sandwich; a toroidal electromagnet is a "doughnut" made up of "turns on wafers." Stating that electric charge was originally measured by the jolt an experimenter could receive from it, the author describes the Leyden jar as a new high in obtainable "joltage."

(*Continued on page* 28)

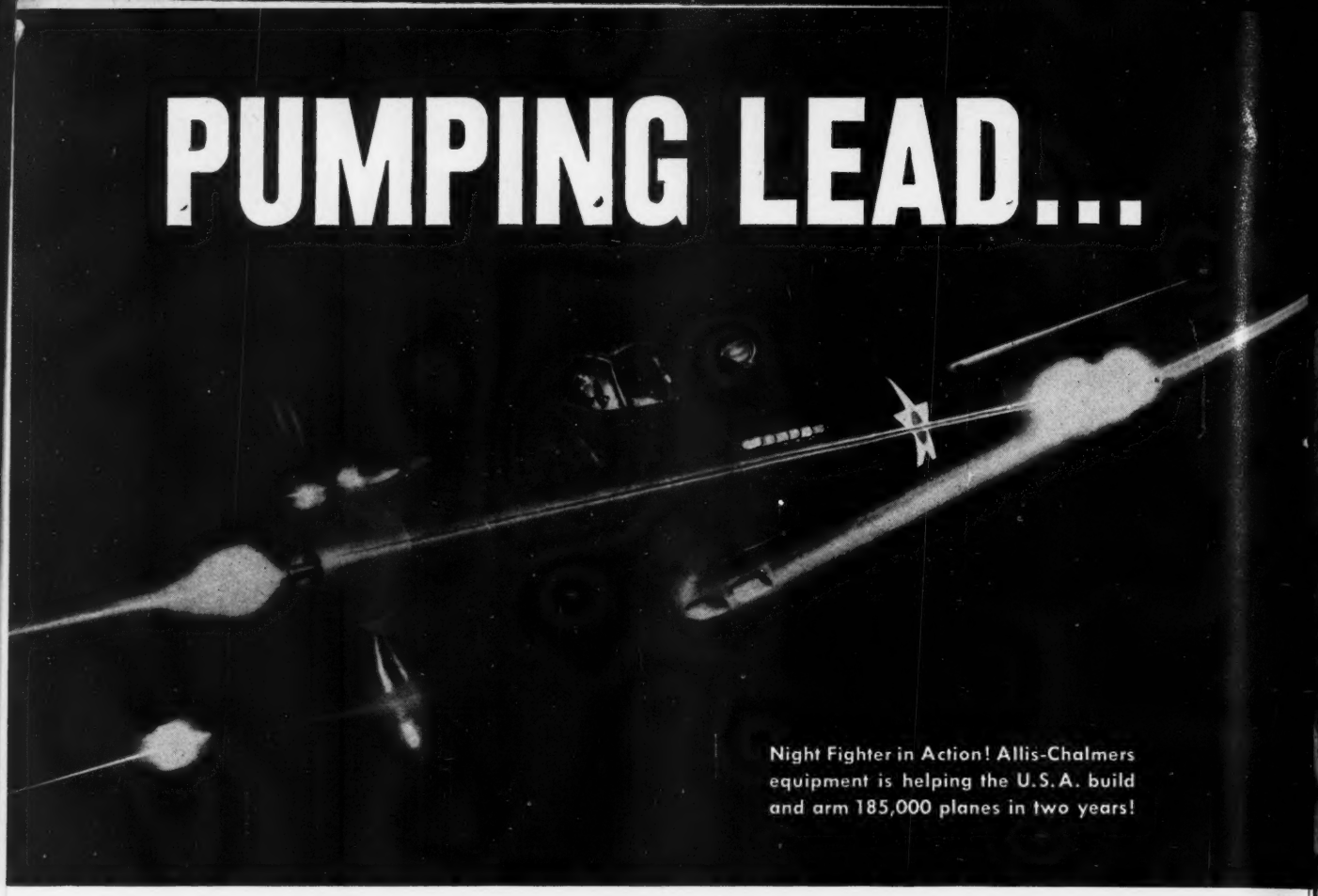
Every branch of the Armed Services uses the telephone. No. 2 of a series, Submarine.

Five thousand miles from home Bill—Torpedoman—is keeping a date. Weeks of waiting, days of watching, hours of hiding under the sea, all for the moment when he reports over his wartime telephone, "All tubes ready, sir!" There'll be other dates, Bill—better ones—in the kind of world you're fighting for.

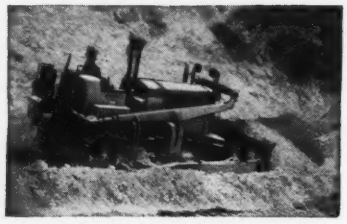
Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

PUMPING LEAD...



Night Fighter in Action! Allis-Chalmers equipment is helping the U.S.A. build and arm 185,000 planes in two years!



A-C Tractors and Bulldozers help build roads and air fields.

Allis-Chalmers equipment helps make cloth for Army and Navy.

Metal for Bullets, Machine Guns, Planes...Water Supply for Cities—flow from Allis-Chalmers Equipment!

BULLET LEAD for Night Fighters is mined and refined with the help of Allis-Chalmers equipment.

So is *steel* for guns—*aluminum* for wings!

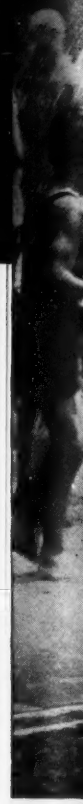
And great pumps which deliver tons of precious water to America's cities are also among the *1,600 Allis-Chalmers products.*

The thousands of Allis-Chalmers employees in 8 great plants are proud that their effort aids production in *every* major U.S. industry.

And in 65 cities Allis-Chalmers engineers are on call to help you produce *more*—not just with new machines, but with machines *now on hand!*

ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

New Allis-Chalmers turbines add to U.S. Industry's growing power.



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OFFERS EVERY MANUFACTURER EQUIPMENT AND ENGINEERING CO—OPER

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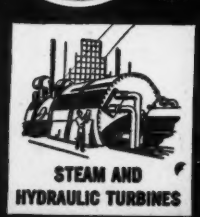
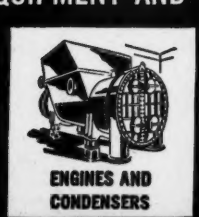


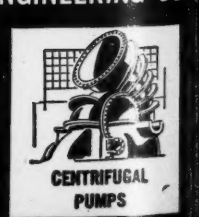
STEAM AND HYDRAULIC TURBINES

MOTORS & TEXROPE V-BELT DRIVES

BLOWERS AND COMPRESSORS

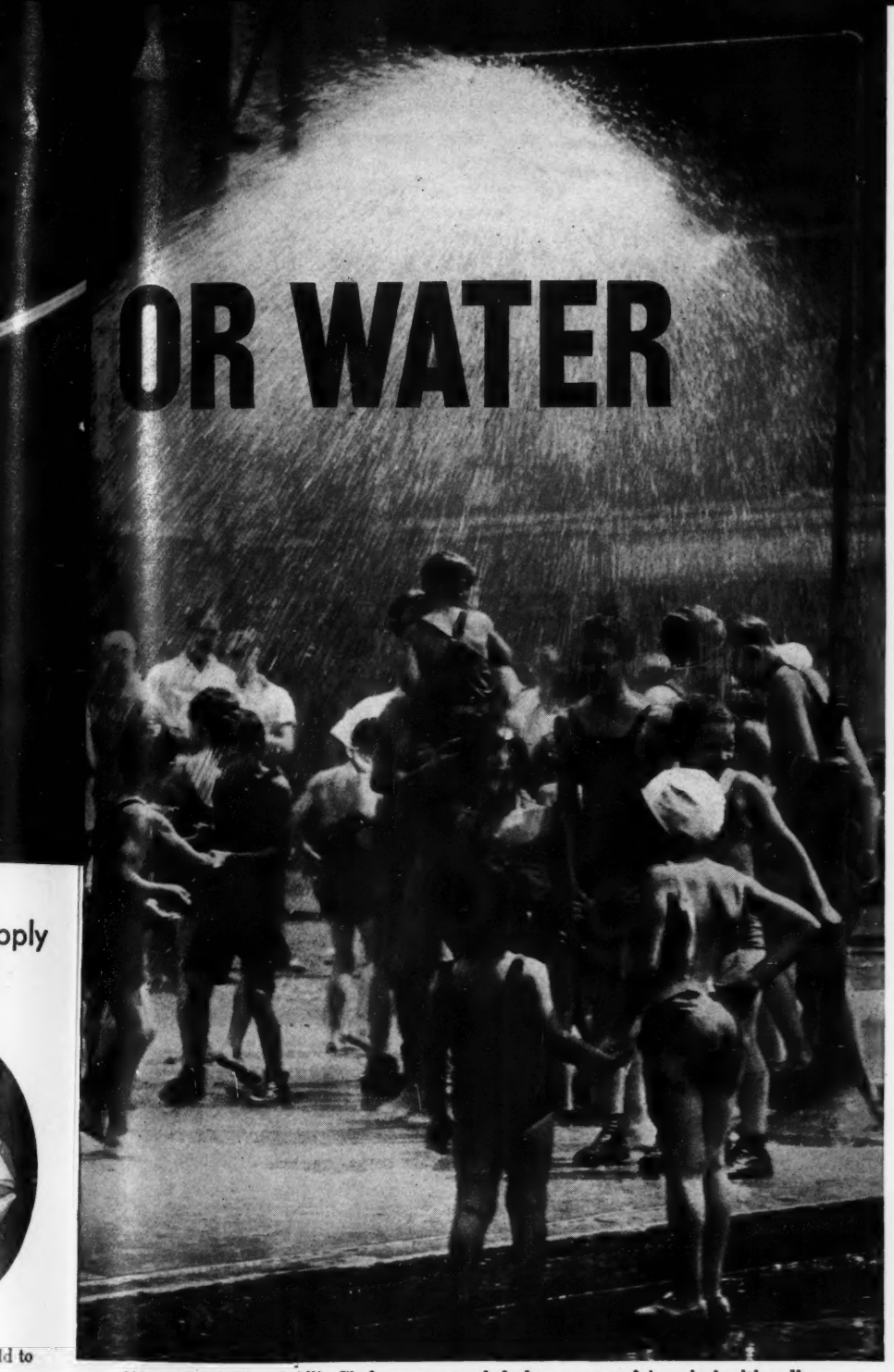


ENGINES AND CONDENSERS



CENTRIFUGAL PUMPS

FLO MIL

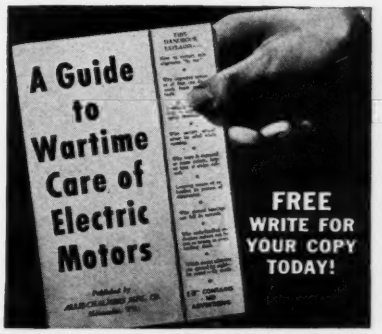


Water for Millions! Allis-Chalmers pumps help keep many of America's cities alive.

VICTORY NEWS

A New Fleet of Tugs is being built for the U. S. Navy. Their principle duty is long towing of disabled vessels in rough seas.

The most powerful of their kind in the world, most of the tugs will be driven by Allis-Chalmers electrical propulsion equipment. Their electrical equipment includes Allis-Chalmers motors, generators and control.



New Handbook on Care of Motors. With motors operating 168 hours a week instead of 40 hours as formerly, most books on motor care are seriously out-of-date.

A new handbook entitled "A Guide to Wartime Care of Electric Motors" has just been published by Allis-Chalmers. It takes a new slant at motor care and is of great value to war plant engineers and maintenance men, and particularly for training new men. *The book contains no advertising, and is available upon request.*

Rush A-C Tractors to World Battlefields. Thousands of gun-pulling Allis-Chalmers track-type tractors will soon see action in Russian and U.S. Forces overseas. These tractors differ from Allis-Chalmers regular commercial models only in additional equipment carried. The army version of this tractor is also speeded up somewhat over the commercial model.

FOR VICTORY
Buy United States War Bonds

HALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

IG CO—OPERATION TO HELP INCREASE PRODUCTION IN THESE FIELDS...

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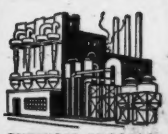
CHEMICAL PROCESS EQUIPMENT

CRUSHING, CEMENT & MINING MACHINERY

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501 Klag Ave., Trenton, N. J.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

Fellow Engineers:

You will be interested to know that the Society has 1330 members which is the largest in its history and compares with 1245 which was the high point reached last year.

Credit for this record is due Wilton Bentley, chairman of the Membership Committee, who not only made his plans last summer but got things well under way early in the fall with the result that our membership has been consistently ahead of last year. This is remarkable in view of the fact that under the present conditions most societies of this character are experiencing a declining membership.

The fiscal year of the Society closes on May 31 and on June 1 we have on our membership list only those who have paid dues in advance which is a very small number. In other words we start with a clean slate on June 1 and names are added as dues are paid.

I feel that it should be the duty of every Cornell engineer to become a member of this Society as it is the only organization representing the engineering Alumni. The dues are reasonable (only $2.00 annually) so please at your first opportunity renew your membership if you are now a member and if you are not, plan to join at once.

The New York Regional Group is indeed fortunate to have as chairman of the Meetings Committee Bernard A. Savage who is now completing his second year in that capacity. He deserves much credit for the many interesting meetings which he has arranged. Last year this group had five meetings but the Executive Committee at their first meeting last fall decided that three meetings this year would be sufficient. Two have already been held and you might be interested to know something of their character.

The first one, held on December 3, was arranged to coincide with the American Society of Mechanical Engineers' annual convention and was exceptionally well attended. James W. Parker '08, President of ASME, Vice President and Chief Engineer of Detroit Edison Co., and a former trustee of the

George N. Brown '08

University, spoke on "The Utilities and the War". Not only did he outline a few of the problems confronting utility companies in our country and how they are being solved, but he told some interesting sidelights on the London, England power layout, explaining how they maintained service even under intensive bombing conditions.

Col. C. E. Boesch, '05, Corps of Engineers, gave a most interesting talk on "Military Construction" especially in connection with cantonments, air fields and depot centers not only in this country but in far-flung bases and theatres of operation.

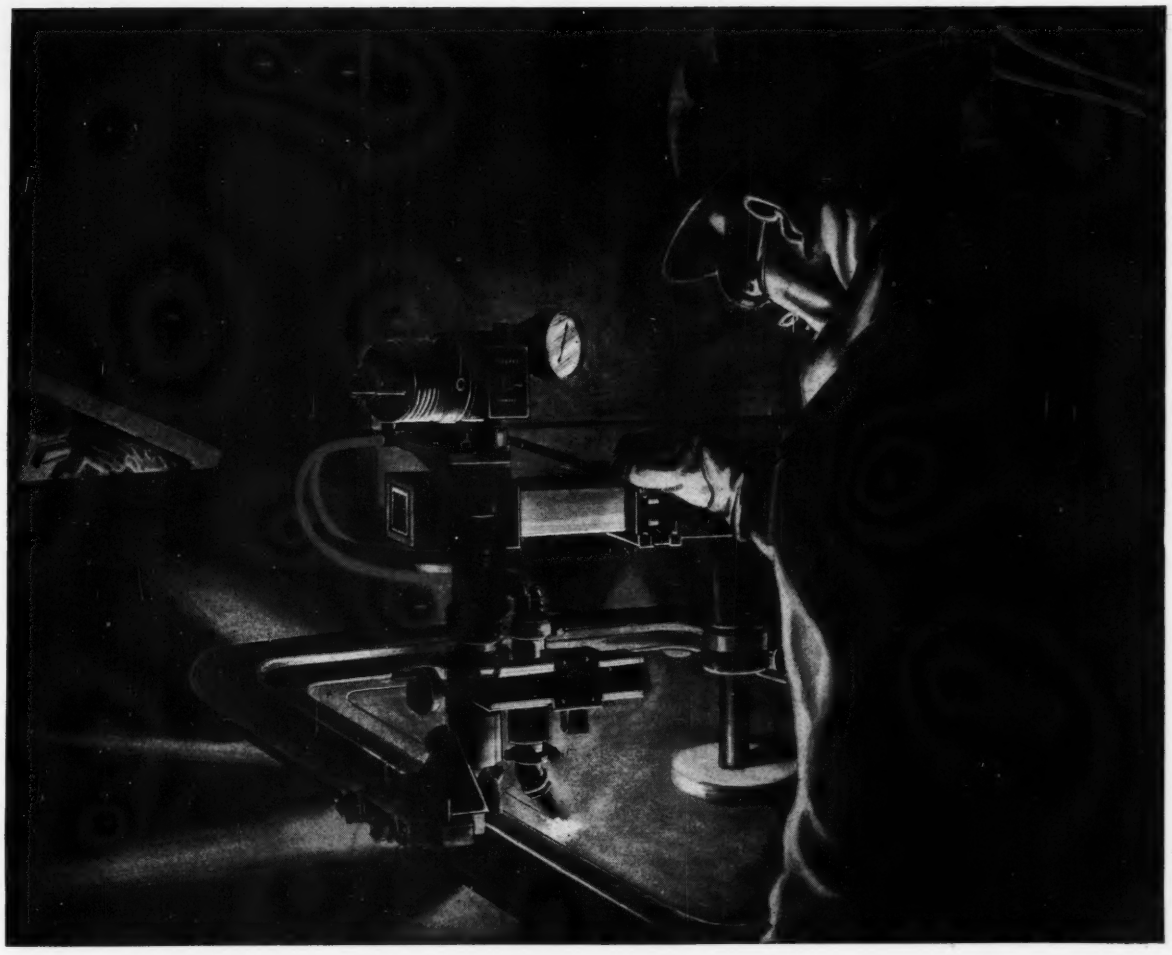
Prof. J. R. Bangs, '19 closed the evening's program with an account, filled with human interest stories of his recent inspection trip covering shipyards on the Atlantic and Pacific coasts and also airplane factories in the Los Angeles area. This was an assignment arranged by James Lynah, Vice President and General Manager of Brunswick Marine Construction Corp., Brunswick, Ga., and the War Production Board. Mr. Lynah is Executive Vice-President of the Society.

Our next meeting was on January 22 to coincide with the American Society of Civil Engineers' annual meeting and on that occasion chairman Savage arranged to have Ezra B. Whitman, '01, President of ASCE, President of the engineering firm of Whitman, Requardt and Smith, and a trustee of the University, speak on "War Plant Construction."

He was followed by Walter D. Binger, Chairman, National Technological Civil Protection Committee, appointed by Secretary of War Stimson and Commissioner of Public Works, Manhattan, who spoke on "An Appraisal of our Civil Defense." Mr. Binger spent a month in London in 1941 as expert consultant to the Secretary of War.

Our next and last meeting of the year will be held during the first week in May. This will be our annual meeting at which election of officers will take place. Notices will be sent in due time so if you

(*Continued on page 26*)



SLICING DAYS OFF SHIPBUILDING SCHEDULES . . .

UNTIL recently, cutting hatchway openings out of heavy deck plating was a bottleneck in the construction of certain types of ships. It was a slow, costly job requiring many laborious machining operations.

Could the oxyacetylene flame eliminate this bottleneck? This was the problem presented to Airco's research engineers by one of its customers. The problem was solved by an entirely new gas cutting machine, designed and constructed specifically to handle this job.

With this machine it is possible to cut beveled openings, rounded at the corners, out of thick steel plate—all in a single continuous operation! The finished cut is smooth and clean, and more important, the openings are cut in 1/120th the time required by the former method. Today this machine—the Airco Polygraph—has become standard equipment in shipyards and many other war production plants throughout the country.

This development is typical of the achievements resulting from the teamwork of Airco engineers and its customers—each contributing their specialized knowledge towards one common objective.

If you want to keep posted on some of the most recent developments and applications of oxyacetylene flame and electric arc processes, write for a free copy of the illustrated booklet, "Airco in the News." Please address your requests to Air Reduction, Room 1656, 60 East 42nd Street, New York.

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ALUMNI NEWS

Niel C. McMath, C.E. '14

Niel C. McMath, CE '14, was recently named president of the Whitehead and Kales Co., Detroit, Michigan. The company fabricated and erected all the structural steel in the Ford Willow Run bomber plant and the Wright Aeronautical Co. plants, as well as for many other large war plants.

Recent Graduates

Word has recently been received that Lyman F. Mears, ME '27 is a prisoner of the Japanese. Mears was called to active duty in February, 1941, and went overseas as a major in a Field Artillery unit.

It has been reported that Lieut. George C. Brainard, ME '38 was one of the three officers who participated in a successful three-day mission against Japanese artillery units during the recent fighting on Guadalcanal.

Roger L. Kingsland, EE '40 has just returned to this country after a year in England doing important work for the Royal Air Force.

Lieut. H. N. Spohr CE '41 has returned to the United States after an extended submarine cruise. Spohr entered the submarine service soon after his graduation in 1941.

Peter M. Wolff, AE '42, former captain of the Big Red football team, has been promoted to first lieutenant at Selfridge Field, Michigan, where he has been assigned since last September.

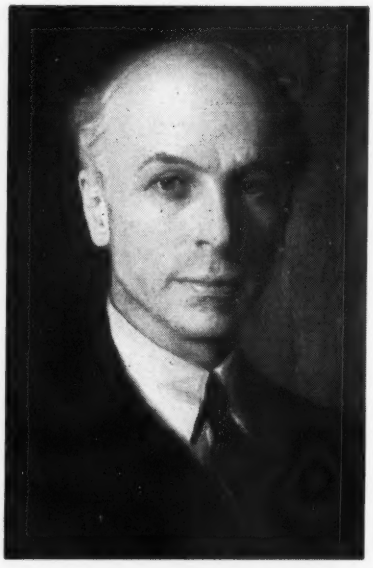
Lieut. Wilbur D. Hart, Jr., AE '41 is a staff officer at the headquarters of the signal section of an Air Force service command in Africa.

Lieut. Wilbur F. Herbert, ME '42 is in Alaska as commanding officer of a fifty-man detachment.

Among the Cornellians who are now members of the Civil Engineer Corps of the United States Navy ("Seabees") are Lieutenant George C. Brode, CE, '34; Ensign Edgar L. Bishop, CE, '37; Ensign John F. Church, EE, '39; Ensign Walter B. Shaw, CE, '41; and Ensign Donald R. Goodkind, CE, '42.

duPont President

In a report announcing the largest sales volume in the company's history, Walter S. Carpenter, Jr. ME '10, president of E. I. duPont de Nemours & Co. reported that all Army and Navy ordnance projects assigned to the company are on or ahead of contract schedules; also that over-all savings to the government on the war orders had been in excess of $260,000,000, and greater unit outputs than were anticipated had made unnecessary the building of several additional explosive plants.



—Alumni News

Walter S. Carpenter, Jr.

Archibald M. Hall, M.E. '24

Archibald M. Hall, ME '24 has been appointed acting manager of the Eastern Division of Vultee Aircraft, Inc., which will build torpedo bombers for the Navy. Hall was formerly manager of the Fort Worth division of Consolidated Aircraft Corp.

Cornell Aviation Unit

News has recently been received concerning the Naval Aviation unit that was recruited at the University last spring by Lieut. Hosea C. Ballou.

It's been a long trail for the Cornell Unit that enlisted in Naval Aviation and went to Chapel Hill, N. C. for pre-flight training. At that time the name of the unit was changed from the "Flying Cubs" to the "Yankee Doodle Dandies," and the boys had high hopes of staying together throughout their training. When the time came to leave Chapel Hill, however, the unit was split up and spread throughout the country.

Hutch Miller ME '44 was sent to Norman, Oklahoma; Jim Farnell, AE '45 was sent to Peru, Indiana; Phil Astry, AE '42 shoved off for New Orleans, Louisiana; Bob Chaffe, ChemE '44 and several of the other boys ended up in Lambert Field in St. Louis, Missouri.

At present, the boys are together at the Naval Flight Training center at Pensacola, Florida where they are receiving their final training. Upon the completion of this training, the boys will receive commissions in the Naval or Marine Air Corps.

A recent letter from them indi-

(*Continued on page* 26)

Use The Cornell University Placement Bureau

WILLARD STRAIGHT HALL

H. H. WILLIAMS, '25 Director

The ***TECO*** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*

New Navy Blimp Hangar, 1000 feet long; 153 feet high; clear-span roof 237 feet. Timber treated for fire resistance according to Federal specifications. Trusses prefabricated by Timber Structures, Inc., Portland, Oregon.

OUR NAVY BUILDS WORLD'S GREATEST TIMBER STRUCTURE

mammoth blimp hangar was made possible by

TECO CONNECTOR ENGINEERING

Two announcements of the widest import to American engineering have just come out of Washington.

The U. S. Navy has announced that a giant blimp hangar, engineered entirely in timber, is nearing completion "somewhere in the continental United States."

The War Production Board has announced that "such a structure could not have been built of wood by ordinary methods without the use of timber connectors . . . The steel ring timber connector, which is used to increase the strength of joints in wood construction, saved more than 400,000 tons of steel for essential war production in 1942." WPB added that 2,050 tons of structural steel will be saved in this hangar alone.

In erecting this vast, multiple-truss assembly, Navy engineers have accomplished a notable achievement in modern timber connector engineering. The hangar is the latest of scores of large Navy, Army, and Maritime Commission projects built with Teco timber connectors under the revolutionary Teco system of timber engineering. It is one of *over 100,000* heavy-duty structures, of *over 600* types, built under the Teco connector system in the past few years. They include clear-span factories, bridges and trestles, towers, tanks, warehouses, docks, shipyards, and many others.

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City Planning

(*Continued from page* 11)

he recognizes and accounts for the limitations. But even with complete statistics and data a perfect plan could not be drawn up. In many cases the cost of required changes is prohibitive, and future conditions cannot often be predicted accurately.

After the maps and charts are drawn up from preliminary studies, they are used as a basis in the development of the plan. For example, in an investigation of the need for a new housing project, several preliminary studies must be made. The various aspects of the proposed location must be taken into account. These include land values, present land use, density of population and the accessibility through present and future means of transportation. These considerations are to insure that the facilities will serve the needs. In studies for different phases of city planning similar data must be obtained. Such overlapping of various studies is apparent through all the phases of planning.

After the material has been gathered and the need for some improvement is seen, a plan is drawn up. If the proposal is accepted, it is incorporated into the Master City Plan. This Master Plan shows the pattern of the future development of the city.

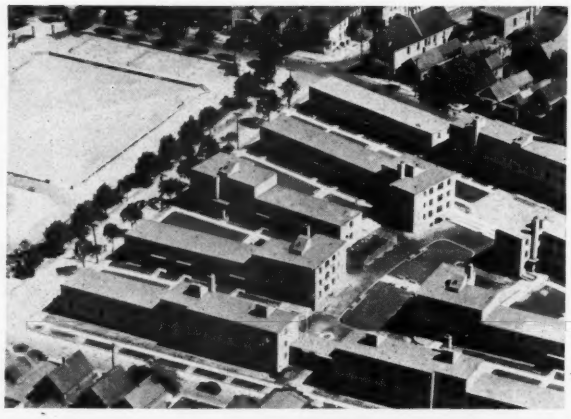
According to Basset, there are seven major studies to be shown on the Master Plan. They are streets, including pedestrian and vehicular tunnels and bridges; parks and parkways; sites for public buildings; public reservations; zoning districts; routes for public utilities; and pier and bulkhead lines.

In a well organized city government the various departments are required to have any major improvements passed upon by the City Planning Commission so that they will fit into the Master City Plan. These improvements grow out of problems which may be classified under the headings of transportation, public works, and housing and zoning.

Transportation

A major problem in any large city is that of getting great masses of people living in outlying areas to and from central sections safely, quickly and efficiently. In recent years, suburban communities have been following the growth outward of rapid transit systems. It has been demonstrated, as in the case of the George Washington Bridge, that the addition of a new artery of transportation greatly stimulates the development of large new areas. In addition, congestion on overtaxed arteries may be relieved by construction of secondary and through routes.

The need for such supplementary routes has been realized in New York City. At present a great system of circumferential and express highways is near completion.[1] Already these routes have diverted a great deal of traffic from the city streets. The completion of the Brooklyn-Battery tunnel, now under construction, will do a great deal towards eliminating congestion on lower Manhattan and Brooklyn.[2]



Planned housing project, Willert Park, Buffalo, N. Y.

Courtesy Civil Engineering

Public Works

Any growing community requires the planning of adequate public works facilities, including water supply, sewage disposal, and the collection and disposal of garbage and rubbish.

The most important consideration in the administration of a water supply system is the maintenance of an adequate supply of pure water, under a pressure which is sufficient for fire-fighting. Since the community is continually growing, it is important that the planners consider factors affecting the future demand for water. Such factors include not only higher industrial and domestic consumption, but also various other uses and developments, such as air conditioning.

As an illustration of this, let us look again at New York City's problem. An investigation during 1927 indicated that the supply would be inadequate about ten years later. Extensive research indicated that the development of the upper reaches of the Delaware River would satisfy future demand. Construction of this project is now near completion.[3]

Sewage disposal is another major public works system. The average life of a sewer system is from thirty to forty years. It must therefore be designed to insure adequate provision for the removal of all domestic and industrial wastes which may be expected during the entire life span of the system. The sewage disposal program should be coordinated with the street plan so that future needs may be taken into account. The sewer system can then be laid before the street is constructed, to avert repaving of streets.

Another important division of public works is the disposal of garbage and rubbish. At present two methods of treatment are incineration and land fill. Incinerators should be so located as to avoid detrimental effect on real estate values. In addition they must avoid unsightly conditions. When the land fill method of treatment is used, the rubbish should be adequately covered by topsoil to pre-

(*Continued on page* 24)

The Goblin that works for America

THE INQUISITIVE alchemists of the Middle Ages were looking for silver. Repeatedly, they smelted certain ores and got a silvery-looking metal. But it was only *silvery-looking*. It never turned out to be silver. So the alchemists thought that a malicious spirit was thwarting them, and they called the strange metal Kobold, meaning goblin.

Today that same goblin, known in America as cobalt, has become one of this country's great fighting elements. Cobalt is alloyed with chromium and tungsten to make "Haynes Stellite" alloys which have the property of "red hardness." Metal-cutting tools made of these alloys keep on cutting even when red hot! Cobalt improves red hardness and toughness in other kinds of metal-cutting tools. Thus, cobalt has contributed greatly to the tremendous output of planes, tanks, guns, and other war materials.

Cobalt is also used to produce improved magnet steels. Permanent magnets of cobalt-tungsten steel are more powerful, and last longer. Permanent magnets are necessary in much electrical equipment.

This country's cobalt formerly came from Belgium, where it was refined from African ores found in the Belgian Congo.

As war clouds loomed, and as accelerated American industry made rapid inroads on the stockpiles shipped out of Belgium during 1938 and 1939, ELECTRO METALLURGICAL COMPANY, a unit of UCC, designed and built facilities in this country for the Belgians. ELECTROMET now operates these facilities so that HAYNES STELLITE COMPANY, another Unit of UCC, and other American companies can have the cobalt they need for essential war work. Operations began in 1941. Today, these facilities annually produce more cobalt than was ever imported in any year previously.

BUY UNITED STATES WAR BONDS AND STAMPS

RED HOT... STILL CUTTING! Faster production of metal equipment of all kinds is made possible by high-speed metal-cutting tools containing cobalt.

SIGHTED SUB! Better radio transmitting tubes and improved electrical equipment are assured by cobalt.

CALLING HEADQUARTERS! Telephones and other electrical equipment require permanent magnets. The better magnet alloys contain cobalt.

WEAR-FIGHTER! Planes fly farther with fewer repairs, thanks to exhaust valves protected with "Haynes Stellite" cobalt-chromium-tungsten alloys.

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The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
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Plastics Division of Carbide and Carbon Chemicals Corporation

City Planning

(*Continued from page* 22)

vent health hazards. In recent years several large cities have shown interest in the possibilities of grinding garbage and discharging it into sewers. Experimental studies have indicated that this method of garbage treatment would not radically alter present treatment methods, but would necessitate the planning of larger and more complete sewer systems to take care of the increased loads.

Zoning

Zoning occupies an important position in any discussion of planning. Scientific control of land use restricts each type of development to confined areas and regulates the bulk, height, and occupied area of buildings. Residential, commercial, and industrial facilities are thus developed to the utmost. Inadequate zoning results in the encroachment of commerce and industry into residential sections, producing blighted areas which often turn into slums.

Today planning recognizes the importance of street width with regard to the height of buildings. In the narrow streets of a city, great masses of people moving to and from buildings create congestion which interferes with traffic and becomes a menace to public safety. These facts were not as obvious at the turn of the century as they are today, and little was done about them.

Through zoning regulations the planning commission is able to effectively carry out its plans for the future.

Throughout this discussion, emphasis has been laid upon coordination. This coordination exists not only in execution of the plans, but also in their organization. The city planner, the engineer, the architect, the public health official, and others work hand in hand, each contributing his specialized training to bring about a safer, happier, more efficient, and more beautiful environment for that section of our population who are city dwellers.

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1. See "Rings Around New York," Cornell Engineer, March 1943, p. 10
2. See "Brooklyn-Battery Tunnel," Cornell Engineer, December, 1942, p. 10
3. See "The Delaware Aqueduct," Cornell Engineer, March 1942, p. 7

Cadettes

(*Continued from page* 9)

Division upon completion of their forty-four weeks of training. There will be various jobs for them in the engineering department. In most cases they will be asked to do detail design drafting. Some may be assigned to do computing or to prepare charts and tables for the aerodynamics, stress or research groups. Some may compile data for the preparation of manuals or operate testing machines in the materials laboratory. In any case each will have the job of assistant until she has shown herself capable of greater responsibility.

The major emphasis of the Cadette program is placed on the development of the individual Cadette and her own individual accomplishments. It is not the intention, when the present course is completed, to have trained an absolutely uniform group of engineering technicians; rather, it is to prepare each Cadette thoroughly in order that she may be best qualified for the particular job in which her country needs her most.

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Of course every one is willing to do without the essential materials that help win the war; everybody knows zinc and steel are among those materials. And *of course* it is just good common sense to take care of the things we have, including galvanized roofing, to make them last as long as possible and give the best service.

HOW TO CONSERVE GALVANIZED ROOFING

You'll find galvanized roofing of various types used on all kinds of structures, on farms, in industrial plants, in housing. It is a valuable material, and with proper care it can be made to last a long, long time; anyhow, until the war is over and necessary replacement material is available.

Galvanized sheets constitute one of the most popular forms of roofing for farm buildings of all kinds. Everything considered, they are also the most economical.

Do This . . .

See that all the roof supports are in good shape. If necessary renail and strengthen them, and replace broken or rotted members.

And This . . .

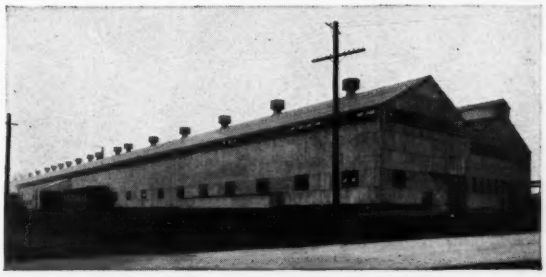
Then bring all the separate sheets into as close alignment as possible. If moisture has a tendency to creep through at the laps, lay a strand of asbestos wicking between the sheets at the laps, and renail the roofing with an approved type of zinc-coated lead-seal special roofing nail with a drive-screw shank. Stubborn lap openings can be effectively closed with hardware screws.

In industrial establishments, where efficiency and economy of materials are of prime importance, galvanized sheets are widely used for various types of structures, from modest homes for employees to the largest of manufacturing plants.

And This . . .

If any of the roofing is showing signs of rusting, paint it with two coats of metallic zinc paint, (see Federal Specifications TT-P-641) which will effectively stop the rust and prevent further injury to the roofing. In fact, the use of this remarkably good paint, which can be readily made by any paint manufacturer, will extend the life of galvanized roofing almost indefinitely.

In "How To Make Galvanized Roofing Last Longer", a booklet published by the Institute, complete and explicit directions are given for all of the above operations. Copies will be sent free upon request.



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President's Message

(*Continued from page* 18)

can join us do so and I am sure that you will have an interesting and enjoyable evening.

The Philadelphia Regional Group held a dinner meeting on March 12 which was addressed by Prof. J. R. Bangs '19. His account of his experiences while inspecting shipyards and airplane factories on both the East and West coasts was most absorbing. At this meeting an election of officers was held and Gordon J. Mertz takes over the chairmanship vacated by Ezra H. Day.

In the Society's annual letter which will be mailed to all graduates of the Engineering College about the time this appears in print, reference will be made to engineers who are in nomination for University trusteeeships. Naturally we like to see the Engineering College well represented on this important board.

Yours sincerely,

George N. Brown,
President.

Cornell Aviation Unit

(*Continued from page* 20)

cate that the Cornell boys are having a lot of fun during their flight training. They have met up with Colgate and Syracuse men which brings them a little closer to home, especially during the football season, when the wagers fly thick and fast.

At Pensacola, the trainees go into larger formation work, instrument work, and then go into specialized training in various squadrons of fighters, dive bombers, torpedo bombers, patrol flying boats, and scouting planes. The boys report that for a good outfit with the swellest guys in the world, and the best flight training, Naval Aviation has got what it takes.

Lewis A. Anderson, CE '40

Lieutenant Lewis A. Anderson, CE '40, has been killed in action, according to a message received from the War Department. Anderson was decorated last November for gallantry in the sinking of a Japanese cruiser in the Southwest Pacific. The action for which he received the Silver Star was described as "probably the final turning point in the eastern New Guinea campaign," by Lieutenant General George C. Kenney, commander of the Southwestern Pacific Air Forces.

The Japanese cruiser was trying to relieve a Japanese supply base at Buna when it was sunk by the Flying Fortress piloted by Lieutenant Anderson. News dispatches first mentioned Lieut. Anderson in October when he piloted his squadron leader, Major William Benn, in the first raids on Rabaul. The squadron was credited with sinking 100,000 tons of Japanese shipping in those raids. A few weeks later Lieut. Anderson was mentioned in dispatches concerning the fighting on and around Guadalcanal.

While at Cornell, Anderson took part in college dramatics and was stroke of the Varsity Crew. While here, he met his wife, Miss Priscilla Denton, who was taking a premedical course. Anderson joined the Air Corps soon after graduation

(*Continued on page* 30)

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Something for you to do, afterward?

A MESSAGE TO MEN ON COLLEGE CAMPUSES

At no time in all the years we have been the confidant of young men approaching a career have we been so sure of the opportunity implicit in your future.

Today, your campus may not be of your own choosing. Your courses, your schedules almost all are pointed toward immediate necessity. Your career is set.

Have you a true conception of how much your special training means to your country? To Victory?

We think you do. But, honestly, don't you catch yourself wondering whether there is really going to be something for you to do, afterward? Are you sometimes in doubt of what's to come after NOW?

We say to you: There is a world to be made anew.

That world is going to offer you creative opportunity surpassing anything we old-timers have ever seen. You are going to have tools and materials and knowledge to work with such as no generation ever had.

We think you are going to find not only a country, but a whole world, waiting for your talents.

And we know that in this country you are going to find a point-of-view throughout industry which is a new thing under the sun. Already countless leaders in industry are laying plans which are based on flat acceptance of the principle that their first responsibility, after all-out production for war, is to make postwar jobs.

We at Alcoa are one group of such men. We are Imagineering now, for you. We intend to do everything we know how to make aluminum make jobs, whether they may be with us, or in a thousand other industries which will be using Alcoa Aluminum when it is again available.

Wherever you are in service, you will surely be in, or around, or supported by, American airplanes. Will you remember two things: They are made largely of Alcoa Aluminum. *And*, the folks who make that metal are even now Imagineering for your future.

A PARENTHETICAL ASIDE: FROM THE AUTOBIOGRAPHY OF

ALCOA ALUMINUM

• This message is printed by Aluminum Company of America to help people to understand *what we do* and *what sort of men* make aluminum grow in usefulness.

Dave Coons

(*Continued from page* 12)

which he is now secretary.

Last summer David was still obtaining variety in his vacation experiences by working in the production engineering department of the Ranger Aircraft Co. Again, he received another "break" when the editor of the Cornellian left school and Dave was promoted from managing editor to editor-in-chief of the 1943 issue.

Soon after the beginning of this, his senior year, Lady Luck blew in again and Dave became a member of the Student Council to fill a vacancy for an Independent Representative-at-Large. He now spends considerable time on the Cornellian, no small part of which is concentrated on solving the problems resulting from shortages of material and labor. He claims, however, that his main occupation has been moving in and out of Cascadilla Hall. Last fall he was co-chairman of the Red Cross blood-donor drive and later in the semester acted as a student advisor to the Influenza Commission. A present he has a job teaching mechanics to a section of Curtiss-Wright Cadettes, not at all an unpleasant way to spend one's time. Besides Tau Beta Pi, Dave is a member of Sphinx Head, Phi Kappa Phi, and Kappa Tau Chi.

Bud McGlaughlin

(*Continued from page* 13)

mail and supplies. Bud says the hunting is good and the fishing, excellent. He has a 24 lb. muskie to his credit, but his Dad's best catch outweighs this by five pounds.

Bud is registered in the Navy V-7 program. He hopes to get into the Navy Air Corps or at least into some branch connected with aviation. His senior option is Aeronautical Engineering, and he has been building gas model planes for years. In fact, he was a pioneer in gas model building, which has become very popular in recent years. Having won several contests, Bud and a pal built a plane which they took to Cincinnati to fly in an endurance contest. They carefully adjusted the controls, filled up the gas tank, and set the thing roaring into the sky. In a few seconds began a great display of barrel rolls and cartwheels; tiring of this, the plane turned nose down and with engine going full blast it slammed into the ground. When the contest was finished, they got a prize for the best stunt flying of the meet.

Hoping he can keep away from such trouble as that, Bud wants to work in aeronautical research or sales.

EE Text

(*Continued from page* 14)

Frequent use is made throughout of analogies of various kinds. The book is notable in that it employs many new, original methods of treatment, rather than following the conventional type of approach.

Quill and Dagger

WARS may come and wars may go but the never-say-die honor and social societies live on. Quill and Dagger and Spinx Head, time-honored Senior honorary societies announced the election of their

(*Continued on page* 30)

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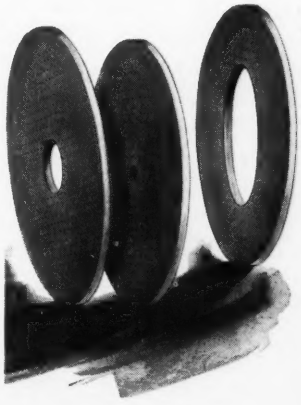
This Merry-go-round has gone to war!

1. It takes a lot of parts to make a Jeep. And this "merry-go-round" has the job of grinding some of those parts (those with flat surfaces)...in a hurry! By rotating a large number of pieces beneath a Carborundum made disc wheel, it surface grinds them in a fraction of the time required by older methods. This process is one which Carborundum helped develop.

2. Surface ground parts for jeeps, tanks and other weapons just couldn't be finished one at a time; production would be hopelessly low. The introduction of disc wheels and the "merry-go-round" surface grinder put surface grinding on a real mass production basis. The method can be used to generate flat surfaces to precision tolerances, on smallest pieces or on massive forgings and castings. It speeds production of many vital war items from valve springs to connecting rods, from piston rings to clutch plates!



3. You'll come to know Carborundum-made products well when you take your place in industry. Whenever you encounter a problem abrasives might solve, please feel free to call on us. The Carborundum Company, Niagara Falls, New York.

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ABRASIVE PRODUCTS

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Anderson

(*Continued from page 26*)

and was commissioned a second lieutenant in May, 1941.

Mrs. Anderson is now a student nurse at the Cornell Medical College in New York City.

Quill and Dagger

(*Continued from page 28*)

new members for the coming year. Those newly elected as well as old members celebrated in proper fashion the morning of February 25 with a milkpunch party. Not trusting their own stability to keep their glasses in their hands, those Q. and D. members who did stagger to their classes that morning came with them taped securely to their hands. Those engineers who were elected include: William Arthur Basse, AE; Chandler Burpee, AE; James Arthur Purdy, AE; Jackson Rinn Pope, AE; William Gordon Whitney, AE; Philip Clarkson Collins, AE; and Richard Hortman Demmy, EE.

Majura, sophomore social society, also recently announced the election of new members to its ranks for the coming year. Contrary to the Q. and D. blow off, there was no public display of exuberance. Several engineers were elected, those being Horatio W. Bacon, ME; Joseph H. Clasgens, ME; Willis L. Davis, AEME; Fred L. Gault, CE; Audenreid Whittemore, ME; and Sanford M. Whitwell, AE.

Faculty Paper

A paper entitled "Electric Propagation on Long Lines Terminated by Lumped Networks" by Professor Michel G. Malti and Dr. Michael Golomb appears in the January issue of the *Journal of the Franklin Institute*. The thirty-three page article obtains solutions for long lines which are intended to improve on the existing literature in two ways. First, fewer limiting initial assumptions are made, and second, the solutions can be more readily evaluated by persons not possessing great mathematical skill, and with less tedious computation. The solution is obtained by means of the Laplace transformation and its inversion.

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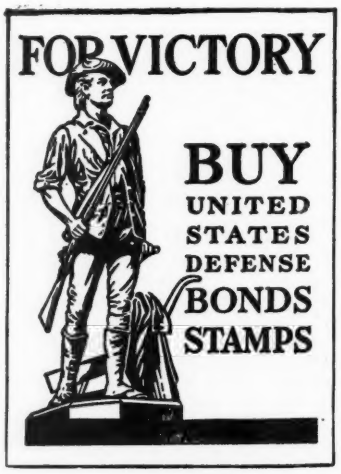

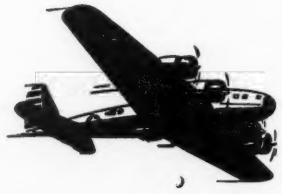

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STRESS and STRAIN...

Then there was the engineer who started on a shoestring and worked up until he got his face slapped.

* * *

Prof: You missed my class yesterday, Smith, didn't you?

Smith: Not a bit, not a bit.

* * *

She: Would you like to see where I was operated on for appendicitis?

He: No, I hate hospitals.

* * *

Then there was the M.E. who took his nose apart to see what made it run.

* * *

Oscar came up on the Hill, got a job in a girl's dormitory, and was intrusted with a pass key to every room in the building. The following week the Dean ran across him in the hall and asked, "Why didn't you come around Friday for your pay, Oscar?"

"Vot, do I get wages, too?"

* * *

There was an old maid who lived in a shoe who had so many children she didn't know what to do—evidently.

* * *

"Sedentary work," said the college lecturer, "tends to lessen the endurance."

"In other words," butted in the smart student, "the more one sits, the less one can stand."

"Exactly," continued the lecturer, "and if one lies a great deal, one's standing is lost completely."

* * *

First Steno: "Why, dearie, the boys run after my kisses."

Second Steno: "That's nothing. After mine they limp."

* * *

Gentlemen may prefer blondes, but the fact that the blondes know what the gentlemen prefer has a lot do do with it.

* * *

First Wolf: "This girl is fresh from the country and it's up to us to teach her what's right and what's wrong."

Second Wolf: "O. K. Pal. You teach her what's right."

Instructor: "What is the advantage of a long pump handle?"

Student: "So you can get someone to help you pump."

* * *

Waitress: "Do you want your eggs turned over?"

Collegiate: "Yes, turn them over to the Museum of Natural History."

* * *

Henry: "Too bad about Bud wrecking his car last night, especially with his girl along."

Frank: "Did something go wrong with his car?"

Henry: "Yes, too much play at the wheel."

* * *

"Did she blush when her shoulder strap broke?"

"I didn't notice."

* * *

After returning from a twenty mile hike, the officer in command of a negro company said before dismissing his men,

"All men who are too tired to take another hike, step forward two paces."

The entire company stepped forward except one big, husky six-footer. Noticing him the officer said,

"Well, Johnson, ready for ten miles more?"

"No, sah," replied Johnson, "Ah's jest too tired to even take dem two steps."

* * *

"What lovely antique furniture. I wonder where Mrs. Smith got that huge old chest?"

"Well, they tell me her mother was the same way."

* * *

A bachelor is a guy who knew when to stop.

* * *

He who laughs last has found a double meaning.

* * *

He: I'll be tickled to see a gas station. The tank is running low.

She: And I guess I'll be tickled if we don't.

"I have to put up with the most questionable people in my work."

"Where do you work?"

"At the information booth."

* * *

"How do chorus girls get sables?"

"The same way sables get sables."

* * *

He: Is there a draught over you?

She: No.

He: Is your seat comfortable?

She: Yes.

He: Will you change places with me?

* * *

A lady was eating dinner in a restaurant when a man came up to her and said, "You look like Helen Brown." The lady angrily replied, "You don't look so hot in that gray suit yourself."

* * *

First Hunter: Good gosh, you almost shot my wife.

Second Same: Did I? Well, here, have a shot at mine.

* * *

"What a splendid fit," said the tailor as they carried the epileptic out of the shop.

* * *

"Shay lishen lady, you're the homliest woman I ever saw."

"Well, you're the drunkest man I ever saw."

"I know, but I'll be sober in the morning."

* * *

Then there was the couple whose car stalled up near Beebe. They got out to push. Somebody stole the car.

* * *

A group of travelers before the war were visiting Mount Vesuvius. An American looked in and exclaimed, "Looks hot as hell."

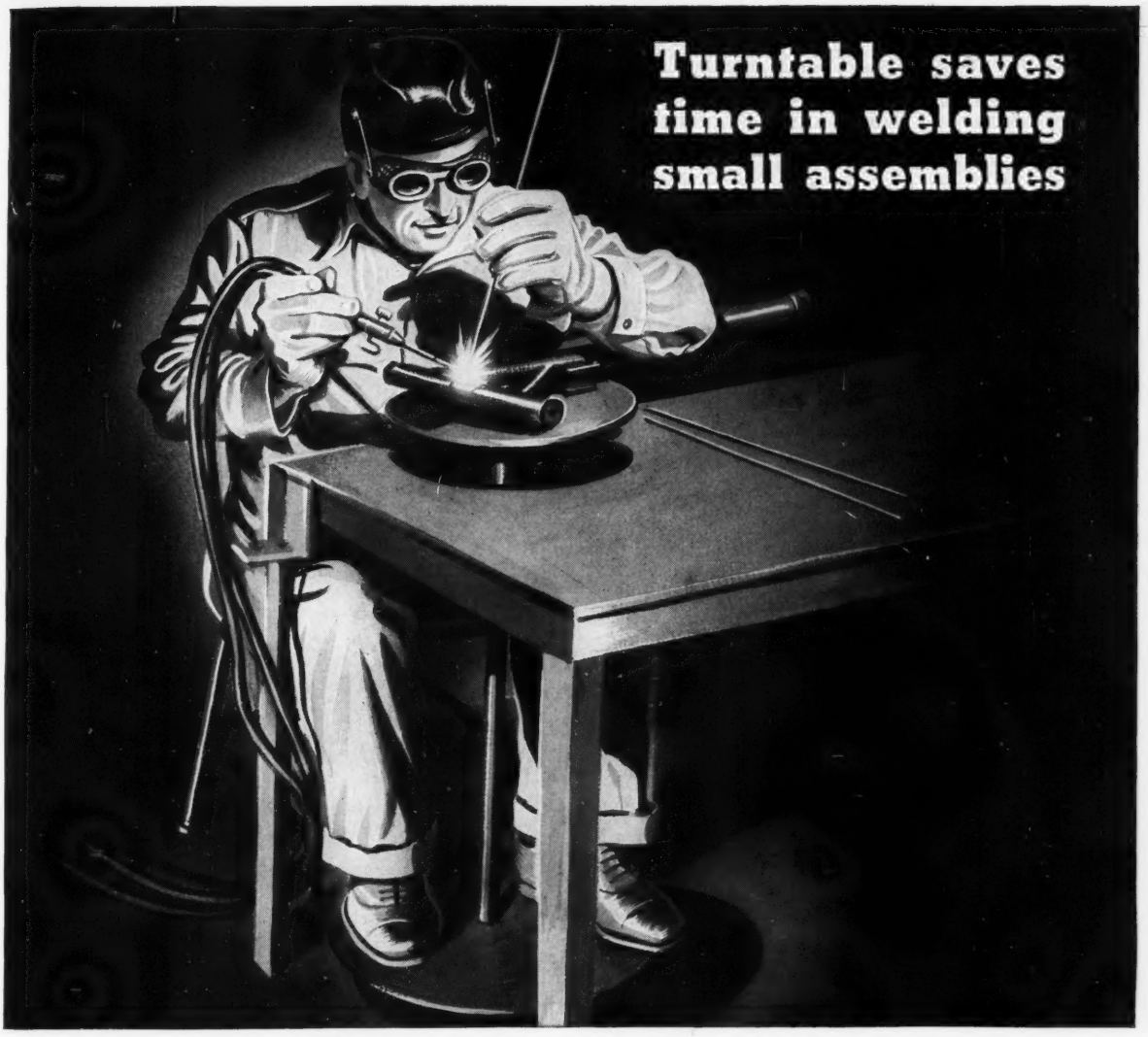
An Englishman standing nearby remarked under his breath, "Those Americans have been everywhere."

* * *

"Nice flock of pigeons."

"Those are gulls."

"Well, gulls or boys, they're a nice flock of pigeons."



Information supplied by an Industrial Publication

Several means are being applied industrially to save time and reduce fatigue of welders working on heavy jobs. Positioning tables, rotating jigs and similar devices for handling heavy or bulky assemblies are quite generally used.

One aircraft manufacturer has adopted a similar idea for welders working on small sub-assemblies. The assemblies are light, and joints are usually quite accessible. But moving the assemblies by hand does occasion some delay.

This is obviated by mounting the work on a small turn table somewhat resembling an old style potter's wheel. The turn table is quite simple, consisting of two round plates mounted on a common shaft.

The upper plate carries the work, and is located at a convenient height above a work table. The lower plate is a few inches above the shop floor. It is positioned so that the operator's feet rest on it comfortably.

Thus, when the operator wishes to move the work, he simply "indexes" the lower table by foot power. The weight of his feet on the plate is, however, sufficient to hold the whole turn table steady while he is welding any particular joint.

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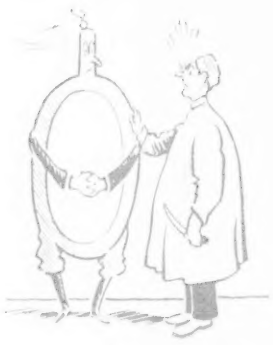

PLASTIC SURGERY

MISTER FIVE BY FIVE had nothing on radio antenna enclosures until the "doctors" of the G-E Plastics Laboratory (PhD's, not MD's) went to work on the problem of streamlining. The result was a plastic housing that a plane hardly knows it's carrying.

That's just one wartime activity of the Laboratory chemists. They're also concocting plastics for fuse caps on mortar shells and for a vast variety of parts for battleships, tanks, and what-have-you's.

The name "plastics" covers a lot of different materials. These G-E chemists are applying the most precise and ingenious chemical techniques to increase that variety. So, if a special job requires a material with combined properties that no existing material has, they go to work to cook up an entirely new plastic to fill the bill.

The whole story can't begin to be told yet. But when it can, you'll be amazed at how far plastics have gone in wartime, and how many new peacetime jobs they'll be ready to tackle afterward.

PUT A NICKEL IN IT

NICKEL'S gone to war. But that doesn't mean that the juke box and pay telephone will soon be operating on a diet of "wooden nickels" and slugs. For every self-respecting coin-operated machine has a magnet attachment that refuses to accept all coins that do not have the magnetic properties of genuine ones.

So, when a new formula for the five-cent piece was needed in order to save nickel and copper for war service, it had to have magnetic properties close to those of the old-fashioned nickel. A number of metallurgical experts were asked for their advice.

Your guess is as good as the next as to whose advice was finally followed, but the formula submitted by the metallurgical section of the G-E Research Laboratory was pretty close to the one picked. The new "nickel" doesn't *have* any nickel in it, and has lost 19 per cent of its copper—and the metals saved are on their way to hit the Jap-pot.

JAP NAP

ONE night Hirohito had a nightmare. He dreamt that Shangri Las were springing up all over and planes were swarming over him like flies.

Perhaps that nightmare is nearer reality than his Imperial Nibs knows. For now, in practically no time at all, any open field, even though the ground is soft, can be transformed into a hard runway for American bombers starting off to make hay of enemy objectives.

To turn the trick, flexible steel mats are laid along the field. By means of resistance-welding machines guided by G-E electronic tubes, steel bars are automatically joined together to form these mats. The speed far exceeds that of a crew of hand welders.

On some dark night, in some deserted spot, our army engineers will swiftly unload these steel mats, joining them into a smooth, solid runway. And presto! Hirohito's nightmare will become a grim reality. General Electric Co., Schenectady, N. Y.

• • •

Listen to the "Hour of Charm" 10 p.m. EWT Sundays on NBC and the G-E news with Frazier Hunt 6 p.m. EWT Tuesdays, Thursdays, and Saturdays on CBS and American (E-M) networks.

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